2007

Financing Port Dredging Costs: Taxes Versus User Fees

Wayne K. Talley
Old Dominion University, wktalley@odu.edu

Original Publication Citation

Talley, W. K. (2007). Financing port dredging costs: Taxes versus user fees. *Transportation Journal, 46*(3), 53-58.

Notes and Comments

WAYNE K. TALLEY

Financing Port Dredging Costs: Taxes versus User Fees

Ships, particularly containerships, continue to grow in size. Containerships exceeding 9,000 twenty-foot-equivalent units (TEUs) in size are now entering some trades, and containerships up to 18,000 TEUs are in the planning stages. One consequence of larger containerships is the burden that they place on ports, e.g., port channels often have to be dredged deeper. How should port dredging be financed? Should a tax be used? If a user fee is used, should shipping lines whose ships use the channel pay this fee? Should the user fee be a national user fee (the same at all ports of a nation) or a port-specific user fee? How should the user fee be assessed, e.g., based upon ship size, type and amount of cargo loaded and unloaded while in port, or time in port per call?

This article discusses tax and user fee programs for financing port dredging costs. By doing so, it provides background information for addressing the above questions. The next section discusses the U.S. tax and proposed Clinton Administration national user fee programs for financing port dredging costs. Then, a port-specific user dredging fee model is presented, followed by a discussion of implementing port-specific user dredging fees. The next sections discuss external benefits and vessel cargo in financing port dredging costs. Finally, a summary of the discussion is presented.

The U.S. Experience

Prior to 1986 the costs of the U.S. government's sponsored programs for the deepening and maintenance of port channels were financed from the federal general tax fund in the amount of 65 percent, with state or local governments being responsible for the remaining 35 percent. In 1986 the U.S. Congress passed the Water Resources Development Act, replacing the federal general tax fund with the Harbor Maintenance Trust Fund (HMTF) as the federal revenue source for financing channel deepening and maintenance costs. The revenue source for the trust fund is the Harbor Maintenance Tax (HMT), an *ad valorem* tax placed on the value of exported, imported, and some domestic (coast and lake, but generally excluding inland waterway) cargo moving to and from U.S. ports. The tax rate was originally set at 0.04 percent of the value of the cargo. With the passage of the Omnibus Budget Reconciliation Act of 1990, the rate was increased to 0.125 percent (effective January 1, 1991).

In 1998 the U.S. Supreme Court declared the HMT to be in violation of the export clause of the U.S. Constitution that "No Tax or Duty shall be laid on Articles exported from any State" (Article 1, Section 9, Clause 5). As a result, the HMT collections from exporters were discontinued as of April 25, 1998—but remained on imports and certain domestic and foreign trade zone cargoes. However, in the same opinion, the Supreme Court also ruled that exporters are not exempt from user fees to defray dredging costs. The Court ruled that a user fee determined by "the extent and manner of port use depending on factors such as the size and tonnage of a vessel, the length of time it spends in port and the services it requires—for instance, harbor dredging" would meet the constitutionality test (U. S. Army Corps of Engineers 2001, 9). The European Union has also been critical of the HMT, equating the tax to an illegal barrier to their exports by being in violation of several GATT

Mr. Talley is the Frederick W. Beazley professor of economics, executive director, Maritime Institute, Old Dominion University, Norfolk, Virginia 23529; e-mail wktalley@odu.edu.

(General Agreement on Tariffs and Trade) articles.

In 1999 the Clinton Administration proposed that the HMTF be replaced with the Harbor Services Fund (HSF) that would be financed from a national user fee (i.e., not port-specific) on commercial vessels. The fee would vary with vessel size, type, and typical number of port calls made by a vessel during each U.S. visit. Vessel type was classified with respect to general cargo (including container), tanker, bulk, and passenger vessels. Vessel size was to be based on the Vessel Capacity Units (VCUs) of each vessel—the net tonnage of the vessel adjusted for cargo and passenger spaces not included in the estimation of the vessel's net registered tonnage (Kumar 2002). The rationale for using vessel type is that different types of vessels require different levels of service in port. Containerships, for example, have tight sailing schedules and thus wish to berth on arrival. Alternatively, tankers and bulk vessels do not have tight sailing schedules and thus have greater flexibility in their berthing schedules. Also, containerships are likely to visit a number of ports on each U.S. voyage, unlike tankers and bulk vessels.

Under the Clinton proposal, tankers and bulk vessels would be levied a user fee for each port call, whereas general cargo and cruise vessels would be levied a user fee only for the first and last ports of call for each U.S. voyage. The user fee would replace the HMT and the funds in the HMTF would be transferred to the HSF. The Clinton Administration argued that the user fee would meet the constitutionality test of the U.S. Supreme Court (by linking revenue collected to services provided in port) and be consistent with the WTO (World Trade Organization)/GATT obligations toward trading partners. However, facing opposition from such key port stakeholders as the American Association of Port Authorities and U.S. and foreign shipping lines, the U.S. Congress did not act on the proposal. Those in opposition argued that the proposal would alter the competitive status quo among U.S. ports and divert cargo to Canadian and Mexican ports. However, the primary reason was likely the fact that user fees would be placed on vessels as opposed to cargo, as for the HMTF program.

Both the HMTF and HSF programs are and would be expected to result in cross-subsidization in financing the nation's port dredging costs, since the tax rate and user fees do not or would not vary across ports. The lower-dredging-cost ports are likely cross-subsidizing or would cross-subsidize the higher-dredging-cost ports—i.e., the surplus HMT revenue (the HMT revenue collected at a port that exceeds the government's dredging expenditure at the port) from a lower-dredging-cost port is used to cover the deficit HMT revenue (the HMT revenue collected at a port that is less than the government's dredging expenditure at the port) from a higher-dredging-cost port. A lower-dredging-cost port may have a sandy bottom, whereas a higher-dredging-cost port may have a rocky bottom. Cross-subsidization among a nation's ports would also likely occur under the HSF program.

Since the programs' tax rate and user fees are the same for all U.S. ports, they do not necessarily reflect the dredging costs of specific ports and thus would not be expected to result in a cost-efficient allocation of dredging resources among U.S. ports. Such a cost-efficient allocation is one for which the deepest levels of dredged water depths for ports are obtained for a given national dredging cost expenditure. Alternatively, if the allocation is cost inefficient, greater cost will be incurred in obtaining these levels of dredged water depths. Consequently, the domestic retail prices for goods that move through U.S. ports will be higher than for a cost-efficient allocation, all else held constant. Furthermore, lower-dredging-cost ports are not being allowed to enjoy to the fullest extent their comparative advantage.

A Port-Specific User Dredging Fee Model

Rather than having a national tax (e.g., the HMT) or national user dredging fees (e.g., the Clinton proposal) to finance port dredging costs, suppose each port is to establish its own user fees for financing its dredging costs. The result might be that higher-dredging-cost ports charge higher dredging fees per vessel call than lower-dredging-cost ports, thus placing the former ports at a competitive disadvantage versus the latter ports. However, this outcome does not necessarily follow. Higher-dredging-cost

ports may have a sufficiently large number of vessel calls that share the dredging costs, thereby resulting in lower user dredging fees than at lower-dredging-cost ports that have a smaller number of vessel calls.

What criteria might be used to establish port-specific user dredging fees? Possible criteria include the following: (1) the revenue from the fees should cover the dredging cost—no more, no less, (2) all vessels of the same type and size that use the channel should pay the same fee, and (3) the fee for a given type and size of vessel should not exceed its standalone dredging cost (i.e., the dredging cost to be incurred when it is the only user of the channel). If the dredging fee for a given type and size vessel exceeds its standalone dredging cost, it follows that the dredged (shared) channel at the given depth is cost inefficient for this vessel, i.e., this vessel can lower its allocated dredging cost by having the channel at a different depth. This cost inefficiency can be investigated by allocating dredging cost among vessels (that utilize a given dredged channel at a given depth) based upon a formula or rule that uses standalone dredging costs, i.e., the rule can determine the allocated dredging cost for this channel for a given vessel, which then can be compared to the vessel's standalone dredging cost for this channel.[1] The pricing scheme of establishing prices for the users of a shared infrastructure or facility based upon a set of criteria for allocating the shared cost of the infrastructure or facility among its users has been referred to in the literature as cost axiomatic pricing (Talley 1994).

Formulae for allocating shared costs that consider the standalone costs of the users have been referred to as alternative capacity rules (Talley 1988). One such formula is Moriarity's Rule. Suppose C_K is the dredging cost at a port to be shared among K types and sizes of vessels. The fraction (f_k) of this dredging cost to be allocated to the number (V_k) of vessels of the kth type and size by Moriarity's Rule may be expressed as:

$$f_k = C(V_k)/\Sigma C(V_k) \qquad (1)$$

where $C_k=C(V_k)$ is the standalone dredging cost to be incurred by the number (V_k) of vessels of the kth type and size that use the channel. The product f_kC_K is the allocated cost share of C_K (or user fee) to be borne by Q_k vessels. If there are T vessels of the kth type and size, the tth individual vessel will be assigned a cost share or fee of $f_kC_K/ \Sigma V_{kt}$. Moriarity's Rule satisfies the user fee criteria 1 and 2 above. It will also satisfy criterion 3 if $f_kC_K \leq C_k$.

Another alternative capacity rule is the Shapley Value Rule,[2] i.e.,

$$f_{kt}C_K = f_{k-1,t}C_k + [(C_k - C_{k-1})/ \Sigma V_{kt}] \qquad (2)$$

where $f_{kt}C_K$ is the cost share (in dollars) of C_K dredging cost to be borne by the tth individual vessel (V_{kt}) of the kth type and size; f_{kt} is the cost share expressed as a fraction. As for Moriarity's Rule , C_k is the standalone cost for the kth type of vessel and size. If the kth type of vessel and size is the largest among the K types and sizes, then $C_k = C_K$. Further, the k-1 type and size vessel is smaller in size than the kth type and size; the k-2 type and size vessel is smaller in size than the k-1 type and size.

By the Shapley Value Rule, the cost allocations (or user fees) of the dredging cost C_K among the vessels that utilize the channel are determined as follows: For k=1 (or the smallest) vessel size, the cost C_1 (or the standalone dredging cost for the smallest size vessel) is divided equally among all vessels that use the channel; the difference between the standalone costs for the smallest vessel size and the next largest vessel size ($C_2 - C_1$) is divided among all ships except the smallest size vessel; and so on until the last cost increment is divided only among the vessels of the largest size. The Shapley Value Rule satisfies the user fee criteria 1 and 2 above. It will also satisfy criterion 3 if $f_kC_K \leq C_k$. The Shapley Value Rule has been used in practice for determining aircraft landing fees at airports.

Implementing Port-Specific User Dredging Fees

There are two types of dredging costs: construction and maintenance. Construction costs may be those incurred in the initial dredging of a waterway, e.g., when a waterway of natural depth of thirty feet is dredged to a depth of forty feet. Construction costs for this same waterway will be also incurred at a subsequent time period if the waterway is dredged to a depth of forty-five feet. Maintenance dredging costs are

incurred when dredging is done to maintain the dredged waterway at a given depth, e.g., at forty-five feet.

User fees can be used to allocate the construction dredging costs of a waterway among the vessels that use the waterway. However, if alternative capacity rules are used to allocate these costs and thus determine the fees, only those vessels for which the dredging of the waterway is necessary (i.e., dredging deeper than the natural depth or dredging a dredged waterway at a deeper depth) would share in the construction dredging costs. For example, only those vessels that require that the waterway be dredged from an initial natural depth of thirty to forty feet would share in the dredging construction cost. If larger vessels in the future wish to use the waterway but require a deeper waterway depth of forty-five feet, only these vessels would share in this construction cost. Alternatively, those vessels for which the natural depth of the waterway is sufficient would not be allocated a share of the dredging construction costs. Note that these results differ for allocating runway construction costs among landing airplanes at an airport. Since there is no natural runway, assuming the runway has to be paved, all airplanes that utilize (land on and take off from) the runway would share in the construction costs of the runway.

Assuming that without maintenance dredging the waterway would eventually return to its natural depth, all vessels that require water depths greater than the natural depth would be allocated maintenance dredging costs. If there is a steady-state dredged depth greater than the natural depth, i.e., a depth that remains without maintenance dredging, then only those ships that require a deeper depth would share in the maintenance dredging cost.

Port-specific user dredging fees for a nation will allow lower-dredging-cost ports to take advantage of their comparative advantage in dredging. However, the port-specific user fees at some ports in a nation may be higher or lower than a national tax or national user fee program. Port-specific user dredging fees are expected to provide for a more cost-efficient allocation of resources for dredging a nation's ports as opposed to a national tax or national user fee program. Dredging resources at higher-dredging-cost ports may move to lower-dredging-cost ports. The lowering of a nation's port dredging costs, in turn, may result in lower domestic retail prices for goods that move through its ports.

Port-Specific User Dredging Fees and Non-Users

Heretofore, it has been implicitly assumed that the benefits of a dredged channel accrue only to the users (i.e., vessels) of the channel. However, non-users may also benefit from the dredged channel, i.e., external benefits or positive spillover effects exist. If so, the public finance literature suggests that these non-users should also share in the cost of dredging the channel. If non-user benefits accrue to the general public, then government should subsidize the dredging costs (Rosen 1985).

The total demand for a dredged port channel is the sum of the user and non-user demands. The share of dredging cost to be borne by non-users (or government) should reflect the proportion of non-user demand to total demand. Alternatively, the share of the dredging cost to be borne by users (or vessels) should reflect the proportion of user demand to total demand. This cost share can then be allocated among individual users (or vessels) as described above by port-specific user dredging fees.

Port-Specific User Dredging Fees and Vessel Cargo

Heretofore, it has also been implicitly assumed that the amount of cargo (or passengers) carried by a vessel has no effect on the amount of waterway water that the vessel draws. However, in reality, a vessel will draw more water and thus require a deeper channel as the amount of cargo transported increases. The amount of cargo transported by a vessel can be incorporated into our port-specific user dredging fee model above by replacing V_{kt}, the tth individual vessel of the kth type and size, with V_{ktr}, the tth individual vessel of the kth type and size transporting "r" tonnage of cargo. If there are ranges of "r" that affect the amount of water that a vessel draws, constraints on "r" will have to be imposed. For example, there may be an initial range of cargo tonnage that does not affect the amount of water that a vessel draws.

It is interesting to note that with the inclusion of cargo in the above model, the user dredging fee model now becomes a user (or vessel) and cargo dredging fee model, assuming that cargo is allocated the cost of dredging attributable to the increase in water (or dredged) depth required by a given vessel in transporting "r" tonnage of cargo. Note that the "r" cargo tonnage would include the weight of the wrapping or boxing of cargo, e.g., the weight of skids for breakbulk cargo or the weight of containers for containerized cargo. Further, the model provides theoretical support for allocating port dredging costs on vessels and cargo.

SUMMARY

In 1986 the U.S. Congress passed the Water Resources Development Act, replacing the federal general tax fund with the Harbor Maintenance Trust Fund (HMTF) as the federal revenue source for financing the construction and maintenance dredging costs of port channels. The revenue source for this trust fund is the Harbor Maintenance Tax (HMT), an *ad valorem* tax placed on the value of cargo. However, in 1998 the U.S. Supreme Court declared the HMT to be in violation of the export clause of the Constitution. In 1999 the Clinton Administration proposed that the HMTF be replaced with the Harbor Services Fund (HSF) to be financed from a national port user fee placed on commercial vessels that call at U.S. ports. Facing opposition from key port stakeholders, the U.S. Congress did not act on this proposal. The stakeholders argued that the proposal would alter the competitive status quo among U.S. ports and divert cargo to Canadian and Mexican ports. Both the HMTF and HSF programs are and would be expected to result in the cross-subsidization in the finance of U.S. port dredging costs, since the tax rate and user fees do not or would not vary across ports.

Port-specific user dredging fees will allow lower-cost-dredging ports to make the most of their comparative advantage, as opposed to national tax and user fee dredging programs. They would also provide for a more cost-efficient allocation of the dredging resources among a nation's ports. The lowering of a nation's port dredging costs, in turn, may result in lower domestic retail prices for goods that move through a nation's ports. However, these fees are likely to vary across the nation's ports.

The port-specific user dredging fee model presented in this article has provided a theoretical framework for implementing port-specific user dredging fees that satisfy the criteria: (1) the revenue from the fees should cover the dredging costs—no more, no less, (2) all vessels of the same type and size that use a given dredged waterway should pay the same fee, and (3) the fee for a given type and size of vessel should not exceed its standalone dredging cost, thereby promoting cost efficiency in dredging. Further, the model provides theoretical support for non-users who benefit from dredged waterways and vessel cargo to be involved in the financing of port dredging costs.

ENDNOTES

[1]If the cost allocations of a port's dredged channel (at a given depth) among vessels that utilize this channel are core allocations, then the channel will be the least costly dredged channel at the port to be shared by the vessels. Three conditions must be satisfied for the cost allocations to be core cost allocations. The Condition of Group Rationality states that the sum of the cost allocations must equal the dredging cost that is allocated. The Condition of Individual Rationality states that the dredging cost allocation assigned to a given vessel must be no greater than its corresponding (for the same channel) standalone dredging cost. The Condition of Coalition Rationality states that the sum of the cost allocations assigned to any sub-group of vessels that use the channel must be no greater than the cost to be incurred in providing an exclusive dredged channel (for the same channel) for this sub-group of vessels. If one or more of these conditions are not satisfied, then the dredged channel at the given depth is cost inefficient for at least one of the vessels, i.e., a vessel can lower its allocated dredging cost by having the channel at a different depth. In our discussion, we have assumed that cost inefficiency arises when the Condition of Individual Rationality is not satisfied. However, it may also arise when the Condition of Coalition Rationality is not satisfied.

[2]For further discussion of the Shapley Value Rule see Talley (1988).

REFERENCES

Kumar, Shashi (2002), "User Charges for Port Cost Recover: The U.S. Harbour Maintenance Tax

Controversy," *International Journal of Maritime Economics*, 4: pp. 149-163.

Rosen, Harvey S. (1985), *Public Finance*. Homewood, Illinois: Richard D. Irwin, Inc.

Talley, Wayne K. (1988), *Transport Carrier Costing*. New York: Gordon and Breach Science Publishers.

Talley, Wayne K. (1994), "Port Pricing: A Cost Axiomatic Approach," *Maritime Policy and Management*, 21: pp. 61-76.

U.S. Army Corps of Engineers (2001), *Annual Report to Congress on the Status of the Harbor Maintenance Trust Fund for Fiscal Year 1999*. Washington, D.C.: Institute of Water Resources Report 00-R-7.