ACCOUNTING FOR FLEET MANAGEMENT IN INSPECTION OF TOWING VESSELS FINAL RULE COST ESTIMATIONS: AN ILLUSTRATIVE EXAMPLE OF THE IMPORTANCE OF CAPTURING THE STATUS QUO

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ABSTRACT

Cost-benefit analysis is an important tool for both the public and private sectors to compare the outcomes of potential projects, decisions, or policies, and to choose the option that maximizes net benefits for stakeholders. However, the accurate estimation of the outcomes of a potential action can easily become confounded by an incomplete understanding of the status quo; of the way things currently are. Federal agencies performing cost-benefit analysis refer to building this understanding of the status quo as "forming the baseline." This paper illustrates the importance of properly forming the baseline by examining the effect of fleet management practices on the cost estimation for the Coast Guard's Inspection of Towing Vessels Final Rule, which published in 2016.

Keywords: Cost-benefit, Baseline, Status quo, Estimation, Fleet management, Towing vessels

INTRODUCTION

On June 20, 2016, the Inspection of Towing Vessels final rule *(1)* was published in the Federal Register. The rule established the new 46 CFR Subchapter M, which prescribed safety regulations governing the inspection, standards, and safety management systems of towing vessels, and detailed the processes by which towing vessels will receive Certificates of Inspection. The promulgation of the final rule was the culmination of a process that began around 12 years earlier in 2004, when Congress reclassified towing vessels as vessels subject to inspections and authorized the establishment of requirements for their inspection under the Coast Guard and Maritime Transportation Act. This action was taken in response to a couple of fatal incidents in the early 2000s during which towing vessels alided with roadway bridges, causing vehicles to fall into the water. The Coast Guard and Maritime Transportation Act was followed six years later by the Coast Guard Authorization Act of 2010, which directed the Secretary of Homeland Security to issue a notice of proposed rulemaking and a final rule enacting requirements for the inspection of towing vessels.

Due to Executive Order 12866 *(2)*, published in the Federal Register on October 4, 1993, federal agencies are required to assess and report the potential economic impacts of a planned regulatory action, before it is published in the Code of Federal Regulation. For planned regulatory actions intended to be published by the Coast Guard, this assessment is called a regulatory analysis and is produced by the Standards Evaluation and Analysis Division within the Coast Guard's Commercial Regulations and Standards Directorate. The main tool that the Standard Evaluation and Analysis Division uses in its assessments of potential regulations is cost-benefit analysis.

Cost-benefit analysis is marginal. It is intended to capture the impacts of a change caused by an action. Therefore, it is essential, when performing the analysis, that the change is accurately represented. For example, if the Coast Guard issued a regulation that mandated the installation of a blue light on the bow of each self-propelled vessel of at least 20 feet in length, then the first question that must be answered is: how many self-propelled vessels of at least 20 feet in length currently have a blue light installed on their bows? If evidence exists that N percent of the those vessels V have already installed the blue light at a cost of C, then the change Δ in cost is not

$$\Delta = V*C,$$

but rather

$$\Delta = (1-N)*V*C.$$

Since N is a fraction between 0 and 1, the second equation must be smaller than the first. In this case, not accounting for the status quo, or the way things currently are, would cause the change to be overstated and the impacts overestimated.

Understanding this status quo is an essential part of the regulatory analyses performed by the Standards Evaluation and Analysis Division. There, and in similar offices of other federal agencies, this process is known as "forming the baseline." For the standard 10-year timeline that is used in most regulatory analyses, economists in the division gather available information on the current practices of the industry that may be affected by the potential regulation and use trends to project those practices through the 10 subsequent years after the publication date. This

10-year projection represents how the industry would progress, if the regulation were not to be published. This is the baseline.

EVIDENCE AND LITERATURE

When performing this process for the Inspection of Towing Vessels final rule, economists in the Standards Evaluation and Analysis Division uncovered evidence to suggest that fleet management practices would substantially alter the expected costs.

Much of the evidence came from expert elicitation of Coast Guard subject matter experts in the Office of Commercial Vessel Compliance. These personnel had extensive onboard interaction with owners and operators in the towing vessel industry either from Coast Guard deficiency check boardings or industry initiated exams under the Towing Vessel Bridging Program. Before becoming reclassified as "vessels subject to inspections" under Subchapter M, these towing vessels were referred to as uninspected towing vessels (UTVs) in Coast Guard regulations. This moniker has been, for some time, somewhat of a misnomer because it seems to suggest that the vessels were not subject to requirements or oversight. However, this was not the case. There are a number of Coast Guard regulations throughout titles 33 and 46 of the CFR that applied to UTVs including those pertaining to load lines, documentation and numbering, manning and credentialing (including route and officer endorsement), equipment carriage, drug and alcohol testing, incident reporting, and pollution prevention, to name a few. While UTVs were not subject to regular inspection, the Coast Guard could board the vessels at any time to ensure compliance with any applicable regulations, issue deficiencies, and restrict movement if it believed continued voyage would pose a hazard. Furthermore, owners or operators of UTVs could request Coast Guard UTV Exams in order to receive UTV decals under the Towing Vessel Bridging Program; a program initiated by the Coast Guard in 2009 to ease the transition from uninspected to inspected towing vessels.

Other evidence came from the existence and prevalence of safety management systems in the towing vessel industry before the publication of the Inspection of Towing Vessels final rule, driven by shipper sentiment and insurance considerations. American Waterways Organization's Responsible Carrier Program, established in 1994, is a prime example. The RCP, along with other safety management systems, is a framework by which companies continually assess and improve their operations to ensure a higher level of safety for their onboard employees and cargoes. One of the main focuses of safety management systems is continual monitoring and maintenance of vessel hull, structure, and equipment.

While literature on fleet management practices for towing vessels was scarce, the economists assessing the final rule were able to find some that highlighted its importance. One in particular, a study published in 2013 by Germanisher Lloyd *(3)*, in cooperation with Fraunhofer CML, reported best practices in ship management (the processes involved in all aspects of a ships life cycle including, but not limited to, financing, procurement, manning, and operation), which were derived from interviews conducted in 2012 with representatives from about 80 ship management companies across the globe. The companies were mostly concentrated in Europe and Southeast Asia, but also included contributors from the United States, China, and Brazil. Most of the ship managers questioned (69%) were wholly employed by the owner-operator of the ships managed, while the remaining managers were employed by independent third parties (22%) or did not specify their employment in the questionnaire (8%)[1]. Fifty-eight percent of the

[1] Note that this percentage breakdown, which is reported by the study, does not sum to 100%. This paper assumes this is due to rounding. Further, the stated 22% is comprised of those ship managers that the study categorized as

companies managed 50 or fewer ships, while 19 percent managed more than 50 but no more than 100, and 19 percent managed more than 100[2]. One part of the subjects on which the ship managers were questioned was technical management. Technical management is the term used by shipping companies to describe the process of keeping vessels in technical operation, which entails planning preventative maintenance, monitoring the condition of the hull and machinery on board, and making repairs to damaged or inoperable equipment.

The interviews with the ship managers shared several unifying similarities. One of which was the need for organized long term plans that provided comprehensive guidance for ship maintenance. In pursuit of this goal, many of the managers divulged that their companies employed a maintenance strategy that combined pre-scheduled maintenance schemes with condition monitoring. This allowed managers to contract cargo around predetermined time slots for maintenance of a routine nature, while reserving those same time slots for sporadic, but not wholly unpredictable, repairs. The study summarized these opinions in one pointed statement:

"Planned maintenance systems are clearly a central part of the increasingly integrated process and IT landscape, but the innovators in the ship management community look beyond. Life cycle management, hull integrity and condition based maintenance concepts, expecting further cost efficiencies and uptime improvements."

The findings of this study were based on interviews with ship managers of large ocean-going cargo vessels, such as tankers, container ships, and bulk carriers. These findings, when considered alone, cannot be directly attributed to the towing vessel industry because towing vessels are much smaller and do not carry cargo themselves (with the exception of articulated or integrated tugs and barges). However, when they are considered along with the prevalence of safety management systems in the towing industry, and with an understanding that towing vessels are intimately linked with these larger cargo vessels in a global transportation network, it can be assumed, with relative certainty, that towing vessel companies hold a similar view of technical management.

DISCUSSION OF RESULTS

Using these various sources of evidence, the economists analyzing the Inspection of Towing Vessels final rule developed the following assumptions to form the baseline:

- Towing vessel owners and operators actively adjust their operations to maximize uptime (time in commercial operations)
- Planned and coordinated maintenance is more efficient than unplanned and discordant maintenance

These assumptions strongly influenced the estimation process for one category of costs detailed in the final rule: lost revenue costs. In theory, these costs are the result any action mandated by the final rule that required a towing vessel be taken out of operation. While the vessel is out of operation, it cannot earn revenue. In the aggregate, these lost revenue costs are the sum of the products of the duration of each provision requiring a lapse in operation T_i, the

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"semi-independent" and "independent 3rd party." Separately, these categories each account for 11% of the managers questioned.

[2] Four percent of the companies did not specify their size in the questionnaire.

number of vessels affected by that provision V_i, and the average daily revenue of a towing vessel, $4,057.50[3]. Formally, this is written as the following formula:

$$\sum 4057.5*T_i*V_i.$$

The economists producing the regulatory analysis identified two cases in which vessels would be taken out of operation due to the final rule: repairing deficiencies that require some type of permanent installation (this does not include storing or installing on board small pieces of equipment, such as PFDs, flares, or fire extinguishers) to ensure the vessel complies with structure and equipment standards, and inspections of various nature. They identified 28 provisions that mandated one of these two cases. Table 1 below lists these provisions.

TABLE 1 Provisions with Potential Lost Revenues

Provision	Description
137.200	Coast Guard Inspections
137.302	Drydocking under the Coast Guard Option
143.225	Means to control and monitor thrust at operating station
143.230	Visible and audible alarms at operating station to alert of emergency situation
143.235	Alarm or announcement system that can notify entire vessel of emergency situation
143.245	Regular testing of essential systems
143.255	Fuel systems
143.260	Fuel shut-off valve fitted on any fuel line supplying propulsion engine
143.265	Fuel system rfor vessels built after Jan 18, 2000
143.270	Exposed piping and tanks
143.400	Electrical systems
143.410	Shipboard lighting
143.415	Navigation lights for vessels over 65 feet in length
143.450	Pilothouse alerter systems for vessels over 65 ft in length
143.460	Towing machinery
144.160	Markings
144.300(b)(2)	Operational test to prove vessel stability
144.315(b)	Deadweight survey
144.315(b)(iii)	Stability test
144.320(a)	Scuppers or freeing ports
144.320(b)	Closure devices
144.330	Watertight review request by OCMI
144.415	Combustibles insulated from heated surfaces

[3] This revenue estimate was, in turn, derived from the daily revenue estimate of a barge ($250) and the average number of barges in a typical tow (15), and inflated to the analysis' base year, 2013, using an inflation factor (1.082).

Provision	Description
144.500	Means of escape
144.600	Ventilation for accomodations
144.800	Handrails and bulwarks
144.820	Guards in dangerous places
144.830	Protection against hot piping
144.905	Operating station visibility

These costs items each varied in the number of vessels affected throughout the 10-year period of analysis, the duration of a potential lapse in operation, and the frequency of lapses for any given vessel over the 10-year period. However, the 10-year undiscounted cost of lost revenue for each was determined and aggregated to form an estimate of the potential lost revenue, based on potentially relevant provisions. Where the original cost estimation did not include a duration estimate (some of the costs for third party professional installation included, but did not itemize, a labor cost component) a range was used with a low of 4 hours and a high of 16 hours, which represented about half to two standard workdays, respectively. Table 2 displays the potential lost revenue for all of the items listed in Table 1.

TABLE 2 Potential Lost Revenue from Relevant Provisions ($millions)

Provision	Potential Lost Revenue	
	Low	High
137.200	$307.5	$307.5
137.302	$28.5	$28.5
143.225	$0.3	$1.4
143.230	$0.1	$0.4
143.235	$1.3	$5.3
143.245	$6.0	$6.0
143.255	$0.4	$1.7
143.260	$0.7	$2.8
143.265	$0.2	$0.7
143.270	$0.1	$0.1
143.400	$2.6	$2.6
143.410	$0.2	$0.6
143.415	$0.6	$2.4
143.450	$4.5	$17.8
143.460	$0.2	$0.7
144.160	$0.2	$0.2
144.300(b)(2)	$1.1	$1.1
144.315(b)	$1.7	$1.7
144.315(b)(iii)	$0.8	$0.8

144.320(a)	$0.1	$0.2
144.320(b)	$1.0	$1.0
144.330	$0.2	$0.2
144.415	$0.0	$0.1
144.500	$0.0	$0.0
144.600	$0.1	$0.1
144.800	$0.0	$0.1
144.820	$0.7	$0.7
144.830	$0.1	$0.1
144.905	$0.0	$0.0
Total	**$359.2**	**$384.8**

This is where the baseline makes its impact. Of the 28 provisions detailed in Table 2, only 8 were used in the lost revenue calculations published in the final rule; fleet management is the reason.

For certification inspections, the Coast Guard provided a considerable amount of flexibility in the final rule with regards to the compliance schedule. The first round of certification inspections does not have to begin for 2 years after the effective date of the rule and do not have to be completed until 5 years thereafter (for companies with multiple vessels). Based on experience with the current Towing Vessel Bridging Program, the inspections occur at a time and place that was mutually agreed upon by the company and the Coast Guard. Inspectors are located across the country, are concentrated where the bulk of towing vessels operate, and can meet vessels during a trip, when they are in port, when they are undergoing normal maintenance, or during downtime between jobs. Based on the flexibilities in planning for, scheduling, and conducting inspections, the Coast Guard does not include lost revenues in its estimate of the costs of undergoing a certification inspection.

Likewise, corrections of deficiencies are thought to cause minimal impact due to the ability for companies to manage their fleets dynamically. The experience from the bridging program is that many deficiencies can be corrected during the inspection and that most require minor activities to correct. For those of shorter duration, it was assumed, following the logic of the literature and the discussions with the subject matter experts, that the repairs could be handled while the vessel continued operation or underwent a survey or dry dock. To recognize the potential for lost revenue to correct more substantial deficiencies, the economists included a day of lost revenue for each standard 8-hour day of labor required for those deficiencies in Section 143and 144 that require at least 8 hours to correct. It is also important to note that each correction of a deficiency that was included, and its corresponding lost revenue, was captured as an independent event. This overstates the lost revenue as multiple repairs can be conducted simultaneously. For example, railings on the deck can be replaced while work is conducted in the engine room.

Furthermore, from a national perspective, it is unclear the extent to which revenues lost by an individual vessel owner represent a net loss to the economy. In most areas of operation or within a larger company, there are a sufficient number of towing vessels that are not utilized at 100 percent to be able to provide alternatives if a particular vessel is undergoing repairs or drydocking. The resulting distributional impact would be a transfer of revenue but not a net loss on the national economic system as a whole

Table 3 displays the total lost revenue published in the final rule by provision, while Table 4 illustrates the importance of fleet management on the cost estimation of the final rule, and, more broadly, the effect of the baseline on regulatory analysis.

TABLE 3 Lost Revenue Published in Final Rule ($millions)

Provision	Lost Revenue
137.302	$28.5
143.270	$0.1
143.400	$2.6
144.315(b)	$1.7
144.320(b)	$1.0
144.600	$0.1
144.820	$0.7
144.830	$0.1
Total	**$34.8**

TABLE 4 Lost Revenue Comparison

Category	Low	High
Total Potential Lost Revenue	359.2	384.8
Total Lost Revenue Published in Final Rule	$34.8	$34.8
Difference	$324.4	$350.0
Total Cost to Industry Published in Final Rule	$345.6	$345.6
Difference as Percent of Total Cost	**94%**	**101%**

The results of Table 4 are dramatic. Through the forming of the baseline, 20 cost items were excluded from the lost revenue estimation published in the final rule, for a total difference of between $324 to $350 million dollars. For perspective, this difference is between 94 and 101 percent of the value of the total cost to industry published in the final rule. This means that if the economists who performed the regulatory analysis had neglected the evidence when forming the baseline, they would have overstated the cost of the project by nearly double. Under those circumstances, the total benefits of $480.6 would have been largely overshadowed by the well over (at least) $650 million in total costs, and the project probably would have been stalled or aborted.

The comparison of Table 4, and the argument provided directly thereafter, is based on the inclusion of one cost item that largely skews the potential cost estimations: provision 137.200, Coast Guard Inspections. While this paper holds that without knowledge of fleet management an analyst or economist may be inclined to include such a provision in the cost estimation (and thus it is relevant to include it in this comparison to highlight the dangers of falsely forming a baseline), it also must acknowledge the existence of a datum that may potentially be an outlier. To that effect, Table 5 has replicated Table 4, without the potential lost revenue of provision 137.200, which composed between 80 and 85 percent of the total potential lost revenue.

TABLE 5 Lost Revenue Comparison without Provision 137.200

Category	Low	High
Total Potential Lost Revenue	$51.7	$77.3
Total Lost Revenue Published in Final Rule	$34.8	$34.8
Difference	$16.9	$42.5
Total Cost to Industry Published in Final Rule	$345.6	$345.6
Difference as Percent of Total Cost	**5%**	**12%**

Though it is not nearly as dramatic as Table 4, Table 5 reiterates the same point. At the low estimate, ignoring the baseline of fleet management practices overstates costs be 5 percent of the total cost to industry; at the high estimate, 12 percent.

CONCLUSION

Cost-benefit analysis is an essential tool for public and private enterprise. However, the accurate estimation of the outcomes of a potential action can easily become confounded by an incomplete understanding of the status quo; of the way things currently are. Federal agencies performing cost-benefit analysis refer to building this understanding of the status quo as "forming the baseline."

In an illustrative example, this paper demonstrated the effect of ignoring evidently prominent practices in the industry on which the analysis is based. Fleet management is of the utmost importance in the towing vessel industry, just as it is to the international shipping network of which the towing vessels are a vital piece. Ignoring these pervasive practices would have grossly overstated the costs of the project, and might have even caused the project to be stalled or aborted.

It is important to note the limitations of cost-benefit analysis. Primarily, it should be noted that the presented results are estimations and projections. Analysts and economists use the best available data and information to calculate the impacts of an action, while looking into an often surprising and unpredictable future. As such, those in charge of the analysis must always take great pains to outline a baseline that realistically accounts for all the information available in the present.

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