

Buoys and Beacons in Economics

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Abstract

The debate over lighthouses has become a central feature of economic theory. It addresses the question of different assignments of property rights and what kind of institutional setting may be able to supply services characterized by limitations to exclude nonpayers and the potential for free-riding conducts. In a seminal work, Ronald Coase (1974) reported on the history of lighthouse provision in England and stressed the role of private investors and private funding for their building and operation. A debate ensued on whether the provision of lighthouse services could be qualified as “private” considering they were financed through “light dues” of a coercive nature. Van Zandt (1993) classifies the different institutional settings in five categories ranging from total private provision and financing to complete government supply. He and other authors claim there are no historical cases of private provision of financing with government enforcement of property and contract rights only. This article shows one such present case in San Isidro, a northern suburb of Buenos Aires. Its existence raises new issues to be considered.

JEL Codes: H11, H41

Keywords: public goods, lighthouses, free riding, excludability, private provision

I. Introduction

Lighthouses have been illuminating the field of economics at least for two centuries. Ronald Coase (1974) reviewed the references of classical economists such as John Stuart Mill, Henry Sidgwick, and Alfred Pigou contributing to the definition of what were later called “public goods,” in particular with reference to the “nonexcludability” aspect; and Paul Samuelson (1964) introduced “nonrivalry in consumption,” though Coase’s aim was to bring up a story that “may

* The author wants to recognize and thank the research program at the Universidad Siglo XXI (Córdoba, Argentina) and the Universidad Francisco Marroquín (Ciudad de Guatemala, Guatemala), both of which made this research possible through their valuable support.

serve to enlarge our vision of the range of alternative institutional arrangements available” (Coase 1974, p. 362).

According to the first principle, nonexcludability, “since it is impossible that the ships at sea which are benefited by a lighthouse, should be made to pay a toll on the occasion of its use, no one would build lighthouses from motives of personal interest, unless indemnified and rewarded from a compulsory levy made by the state” (Mill 1848, book V, chapter XI, V. 11.57). This nonexcludability is the free-rider problem. The second, nonrivalry in consumption, states that even if it were possible to exclude free riders, it would not be efficient to do so since the marginal cost of an additional user would be zero. This second principle basically assumes noncongestion and unlimited supply to all potential users, at least within a comfortable range.

The institutional arrangement for the supply of these services, though, seemed to be different for Coase and Mill on one side, Samuelson on the other. Public goods must provide for two different kind of solutions: financing and provision. It appears that Samuelson had government financing and provision in mind since he denies the possibility of private provision because “a businessman could not build it for a profit” and “this is certainly the kind of activity that governments would naturally undertake” (quoted in Coase 1974, p. 358). Mill seems to have considered government financing through light duties and private provision.

No wonder Mill thought so; that private entrepreneurs or other organizations built and managed some lighthouses, and financing came from light duties imposed by government, was more or less the institutional arrangement throughout Europe since lighthouses started to be built in the sixteenth century (Lindberg 2009).

II. Trinity House, Private or . . . ?

Coase’s analytical narrative was based on the history of the British system between the sixteenth and nineteenth centuries and the roles played by the Lord High Admiral, Trinity House, and private entrepreneurs.¹ Trinity House is the General Lighthouse

¹ He describes Trinity House as an ancient institution, supposedly evolving out of a seamen’s guild, a description matched by that of Trinity House itself: “It is often stated that the origins of Trinity House date back to a charitable guild of sea Samaritans established by Archbishop Stephen Langton in the 12th Century. The first official record is the granting of a Royal Charter by Henry VIII on 20 May 1514 to a fraternity of mariners called the Guild of the Holy Trinity ‘so that they

Authority (GLA) for England, Wales, and the Channel Islands, providing aids to navigation from lighthouses to buoys to satellite navigation technology. It also inspects local aids provided by port authorities. Its expenses are covered by the General Lighthouse Fund, with revenues coming from light dues paid by commercial shipping. It still keeps its original charity activity, though separately from the GLA activities. The light dues are set by the Department of Transport and are payable per net ton on commercial shipping only for the first six visits to a UK port per year.

Coase describes, and Trinity House confirms, that many lighthouses were privately built, operated, and maintained through licenses obtained from Trinity House or the Crown itself.² The main goal of Coase's article is to debunk the generally accepted idea that government financing and provision of public goods is the only viable alternative, with lighthouses as the usual example. He does not rule out other possibilities, arguing that the account of the British system reveals just some of them (Coase 1974, p. 375). In a subsequent paragraph, he describes the system as "private," although clearly referring to provision and not to financing.³ Coase's mention

might regulate the pilotage of ships in the King's streams'. At the time of inception, this charitable Guild owned a great hall and almshouses, close to the Naval Dockyard at Deptford on the River Thames.

"The granting of the charter came as a result of a petition given to him the year before by the 'Masters, rulers and mariners of the King's Navy in the Thames and other places' dated 13 March 1513. While no official paper records survive to corroborate the evidence two gravestones in Leigh Church in Essex indicate the existence of an organisation concerned with the welfare of seafarers on the coasts of England in the fifteenth century. The gravestones each record the name of a 'Trinity Brother' lying beneath." (Trinity House, n.d.)

² "The tolls were collected at the port by agents (who might act for several lighthouses), who might be private individuals but were commonly customs officials" (Coase 1974, p. 364). All these private lights were compulsory purchases after a law was passed in 1836, and they were placed under the management of Trinity House. The argument, then and now by Trinity House (n.d.), is that the reliability of many of these private lights left much to be desired, though Coase argues for a rent seeking motivation, an expectation from users that it would lead to lower light dues, an argument recently stressed by Carnis (2013).

³ "The early history shows that, contrary to the belief of many economists, a lighthouse service can be provided by private enterprise. In those days, shipowners and shippers could petition the Crown to allow a private individual to construct a lighthouse and to levy a (specified) toll on ships benefitting from it. The lighthouses were built, operated, financed and owned by private individuals, who could sell the lighthouse or dispose of it by bequest. The role of government was limited to the establishment and enforcement of property rights in the lighthouse.

that lighthouses were “financed” by private individuals refers to the original capital investment to build them, not to their operation and maintenance that we know came from the light dues. Nevertheless, his statement sparked an intense debate over whether this institutional arrangement could be called “private.”

The first to throw a stone was van Zandt (1993), arguing that private enterprise “hardly captures the reality of the provision of lighthouse services” since “the government played a substantially greater role in the provision of lighthouse services than Coase’s term ‘private’ suggests” (p. 48). Later on, both Bertrand (2006) and Barnett and Block (2007) raised the same concern, although with different perspectives: Bertrand shows there were charitable organizations providing and financing lighthouses, though she does not take them to be “private enterprises” since they are not profit motivated, while Barnett and Block argue that the charitable sector of the economy is private because it is the result of voluntary actions, like those of profit-maximizing firms. Barnett and Block, based on their definition of “private” as “voluntary,” define the British case as presented by Coase as “governmental, not market-based supply” (Block and Barnett 2009). Lindberg (2009, p. 23) and Block (2011) also consider the case presented by Coase as “governmental,” or tax-based.

Financing through government-imposed light dues shows a much needed government role in solving market-failure problems for some researchers, while it is just evidence of governmental taxation for others, though complete private provision and financing could be imagined.

Van Zandt (1993) develops a different classification, following the idea of a “continuum” of institutional arrangements between purely private voluntary and purely government compulsory. Both classifications are not incompatible; there may be different alternatives that fall into one or the other camp. This is how van Zandt (1993, p. 56) defines them:

1. Private provision with no government enforcement of property and contracts rights
2. Private provision with government enforcement of property and contract rights only

The charges were collected at the ports by agents for the lighthouses. The problem of enforcement was no different for them than for other suppliers of goods and services to the shipowner. The property rights were unusual only in that they stipulated the price that could be charged.” (Coase 1974, p. 375)

3. Private provision with government fixing rates, granting monopolies and enforcing collection of specified user levies
4. Government provision from collection of specified user levies
5. Government provision from general revenues

Samuelson uses the lighthouse example as one of public goods that fall within category 5; Coase describes a British system along option 3. Most countries have systems falling under category 3 or 4; examples include those under management by the United States Coast Guard (USCG), the Canadian Coast Guard, or the Australian Maritime Safety Authority. The USCG has concentrated on automated beacons and maintenance of aids to navigation on steel structures or buoys rather than on lanterns inside traditional lighthouses, which were neglected and subject to vandalization until they were leased mostly to local historical societies and other organizations or sold as excess property to them. Chile offers an example of government provision from general revenues (category 5), with lighthouses and all navigation aids being financed out of the national treasury and managed by the Maritime Signalization Service from the navy.

This article, though, will present a case of private provision with government enforcement of property and contract rights only, falling under category 2. Imagined by some, denied by many others, the case shows government failure at its best and a private voluntary solution that is not perfect but that works. It breaks the myth that such provision is impossible due to market failure and, further, in a comparative institutional analysis, it comes out as a respectable option.

III. A Private, Voluntary System

Van Zandt (1993) and Block and Barnett (2009) explore the possibility of a private voluntary system. Van Zandt (p. 56) says,

There are, however, no examples of lighthouses operating in the pristine “private” world (category 2) in which the government only protected property entitlements and enforced consensual deals. In almost every case, the government did much more. It granted the lighthouse owner a monopoly on the provision of lighthouse services at a

particular location; it set and enforced a fixed schedule of “light dues”; and it assisted the lighthouse operator in collecting his light dues against nonconsenting ship captains. The only exceptions to this generalization were the lighthouses provided by religious persons or entities; in those cases, while the government was not always involved, it is likely that similar socially coercive devices were used to overcome the particular problems of the lighthouse.

Social coercion is different from government coercion; the latter includes force or the threat to use force, following from Max Weber’s definition of the state as a monopoly on the use of force in a certain territory, a definition implied in Barnett and Block’s argument. Therefore, religious persons or entities either defy such a monopoly (as would a criminal, a mafia, an insurrection, or a foreign power) or not, in which case contributions to them are voluntary: religious entities cannot send nonpayers to jail or freeze their bank accounts, nor call the government powers to do it.

Van Zandt considers how technology could turn a “nonexclusion” situation into one where exclusion is possible and private provision, therefore, is possible. If entrepreneurs cannot exclude free riders, the provision of a certain good will not be possible on a for-profit basis or may lead to overconsumption of a resource. The typical example is cattle, threatened with extinction at some point though multiplied after the introduction of barbed wire and property rights.

He acknowledges there could be ways to collect fees on a contractual basis, although they were not developed during the history of lighthouses. He speculates that if radio existed, lights could have been turned on by request; that is, the ship captain could call the lighthouse owner to turn on the light in exchange for a certain price. Less likely, considering modern technology, is the option to place employees in small boats along the outer range of the lighthouse’s light, and when a ship approached, to strike a deal and signal the lighthouse keeper to turn on the light. These examples may seem weird or naïve after all these years of technological innovation, but van Zandt is right in pointing out that the problem of excludability is a contingent one. He correctly concludes in this section that costs depend on existing technologies, and when a new technology becomes cost effective, entrepreneurs will find it worthwhile to

provide the good. Therefore, public goods are such only within certain legal and technological contexts.

Block and Barnett (2009) mention other possibilities. One of them is insurance. Since safer navigation ways would result in lower insurance rates, ship owners would be interested in securing the services of lighthouses or other navigational aids. “No one can be sure of the details,” they write, “but it seems very reasonable to think that owners or shippers or insurers, or a combination thereof, would form an organization to provide such services.” (p. 4).

Another method is moral suasion. Lighthouse owners could give negative publicity to those free riding on their services, or they could set up a voluntary association. Block and Barnett (2009) say, “Yes, of course, just as cartels tend to break up over both internal and external challenges, such an arrangement might not be definitive. But, it might work in some cases where transactions costs were low, and the given trade route was used by only a few” (p. 3). The following will demonstrate a case of just such an institutional arrangement.

IV. Private and Voluntary Buoys and Beacons in the Río de la Plata and the Paraná Delta

The Paraná River flows for 3,000 miles through Brazil to the Río de la Plata basin, meeting the Uruguay River, where the land splits into numerous islands forming the Paraná Delta. Buenos Aires lies at the beginning of the Río de la Plata; the city grew northward up to the delta region, with suburbs full of both commercial and pleasure yachting activity.

The muddy Paraná River that creates and extends the delta also tends to embank the navigational ways of the Río de la Plata, making navigation difficult and even dangerous and causing boats to get stranded. Navigational aids are essential in these shallow waters. These aids are the formal responsibility of a government agency (Servicio de Hidrografía Naval) within the defense ministry. It is funded out of the federal budget, which would fall within van Zandt’s government provision from general revenues (category 5).

The study and evaluation of institutional frameworks is an instance of comparative analysis between real world alternatives, not ideal ones. Otherwise, we fall into the nirvana fallacy (Demsetz 1969).⁴ Both Coase (1974, p. 362) and van Zandt (1993, p. 57) also

⁴ “The view that now pervades much public policy economics implicitly presents the relevant choice as between an ideal norm and an existing ‘imperfect’ institutional arrangement. This nirvana approach differs considerably from a

stress the importance of institutional comparative analysis of real, not ideal, systems. And the real world of governmental provision and financing showed that the government was concerned with navigational aids and the depth of water in the Paraná channel for large commercial ships but slowly neglected the coastal waters mainly used by sand or wood transportation barges and recreational sailboats and motorboats.

In 1989, the northern coast of the Río de la Plata lacked almost any buoys and beacons, in a context of growing recreational navigation. GPS services were still not available. Government failure led to entrepreneurial reaction. That year, the presidents of two yachting clubs, Yacht Club Argentino (YCA) and Club Náutico de San Isidro (CNSI) agreed to set up a new nonprofit organization including all yachting clubs and private marinas in the area. The first step was to close a deal with the Servicio de Hidrografía Naval (SHN) to have it perform a bathymetric survey (a study of underwater depth), with extra costs financed by the private clubs. The result was a nautical chart, named UNEN 1, later widely used and merged with governmental charts that were updated.

That same year, a nonprofit organization was created called Unión de Entidades Náuticas (UNEN) (Union of Yachting Organizations).⁵ UNEN started anchoring the first buoys UNEN 1, UNEN 2, and UNEN 3, and it repaired and painted beacons 7 to 10 and other coastal aids. The CNSI donated a marker barge that UNEN used for these operations. The first buoy, “Pumper Nic,” was funded by and got its name from a fast-food company. UNEN located shipwrecks.

A new marker barge was built at the CNSI dry dock in 1994, so far financed from the private club’s own revenues. At that time, a new system of financing was introduced with a charge of one peso per boat in each of the member clubs. New buoys were set in 1996, UNEN got legal status as a civil association, and the marker barge and an additional motorboat became its property.

comparative institution approach in which the relevant choice is between alternative real institutional arrangements.”

⁵ See “Bienvenidos a Unen,” <http://www.boyadounen.com.ar/>.

Picture 1. One of UNEN's Buoys Being Set Up



Source: UNEN, <http://www.boyardounen.com.ar/boyas.html>

Picture 2. UNEN's Buoy in the Northern Río de la Plata



Source: UNEN, <http://www.boyardounen.com.ar/boyas.html>

Up to the present, UNEN has continued setting new aids and servicing the existent ones. Property of the waterways is governmental; UNEN even has to request permission to set up a new buoy to the SHN that gives the detailed characteristics of the aid. UNEN then sets it and reports to SHN, which adds it to the nautical charts. In this case, therefore, financing and provision, save for the water position, is private. Could this qualify in van Zandt's category 2, "private provision with government enforcement of property and contract rights only"?

In fact, it seems to be a case of what he could not find: "The one structure conspicuously absent is private provision with minimal state involvement (category 2)" (Van Zandt, p. 58). UNEN also sets beacons on private lands, either from its own member clubs or from other private owners.

Picture 3. UNEN's Marker Barge



Source: UNEN, <http://www.boyadounen.com.ar/boyas.html>

Picture 4. One of UNEN's Beacons



Source: UNEN, <http://www.boyadounen.com.ar/novedades.html>

UNEN member clubs have around 6,000 boats/users. Free riding of member clubs is easily checked: Google Earth allows UNEN to control the number of boats in each of them. Clubs charge boat owners mooring fees, which may make the UNEN fee explicit

or not. Nevertheless, the charge is a minimal percentage of the fee. Are there any free riders? UNEN officials estimate that there are 12,000 other boats in the region, almost all of them from private marinas and boat guards. These for-profit organizations have shown the typical “free rider” conduct: accepting the benefits of the services though postponing or denying payment with different pretexts.

Does the existence of free riding condemn private “category 2” solutions as inefficient? That would be Bertrand’s (2006) argument, though, as usual in neoclassical economics, as compared with an ideal optimum. Block and Barnett (2009) raise the point that many firms operate even while not able to exclude all beneficiaries, and our case is closer to what they state.⁶

Again, UNEN’s results should be compared with the existing situation under straight government responsibility. Would a “category 3” solution (private provision with government fixing rates, granting monopolies, and enforcing collection of specified user levies) be more efficient? It could be argued that enforcing light dues for these 12,000 free riders, something the government could do with its coercion power, would bring more revenues and open the door to many more services. Of course, that is a hypothetical outcome. It may well be that lobbying and political favoritism end up funding unnecessary expenses. So far UNEN has resisted this temptation and has not asked for governmental enforcement.

Another hypothetical solution, which should get the same consideration as the one above, is entrepreneurial technological development allowing the exclusion of free riders. Some authors have mentioned buoys and beacons that turn on via cell phone or radio communication when activated through a code. Solutions like these have a long history, ranging from barbed wire to enclose land and cattle to the encryption of satellite signals that must be unlocked by a paying user.

Foldvary (2003) envisions a change in the allocation of property rights in waterways, allowing right holders to locate trespassers

⁶ “Need any or all of these threats eliminate 100% of all possible free riders? No. There are many firms that continue to operate without being able to exclude all recipients of any conceivable external benefits. For example, long before government began to subsidize higher education in the United States there were thousands of such institutions sending forth educated citizens into society, benefiting not only the institutions, and the students, but society at large. In similar manner, lighthouse owners might well have been able to continue in business without deriving payments from each and every last person who benefits from their commercial undertakings” (p. 4).

thanks to modern electronic technology.⁷ UNEN itself could enforce light dues for free riders if it had the right to exclude nonpayers.

A solution like this one is close. The commercial channel of the Paraná River has been licensed to a private company, Hidrovía, that charges tolls to its users and is in charge of maintenance of navigational signals and dredging over 400 miles. The concession contract includes the compromise to keep a depth of 10 feet in some areas and up to 35 feet in others (where most of the agribusiness exports are shipped) and the provision of 338 beacons and buoys over the entire range.⁸

Another altogether different possibility has buoys and beacons becoming redundant through the extensive use of GPS and even automatic piloting.

A. Other examples in the region

This is not the only case, though. The area shows other examples of private provision and financing of goods with so called “public good” characteristics.

Picture 5. Port of San Isidro Channel



Picture from <http://www.histarmar.com.ar/Puertos/SanIsidro-BsAs.htm>

The Port of San Isidro in northern Buenos Aires is governmental property and, like many such others, it is neglected and decayed. The

⁷ “If the aquatic area near the lighthouse is privately owned space, or if the governing agency asserts similar property rights, then any entrants are trespassers unless explicitly welcomed. Radar, sonar, and other electronic signals can detect the presence of intruders, and then alert them by radio that they are entering a private zone requiring payment. If the ship or boat persists in its entry, then the protective signalling is provided, and the private owner can be entitled to fine the intruder beyond the usual fees.”

⁸ Hidrovía, <http://www.hidrovia-sa.com.ar/>.

channel passage to the port entrance, though, is used by several private yachting clubs and even the government's coast guard (Prefectura). As such, the channel is government property, but dredging and maintenance is carried out by the Club Náutico San Isidro (CNSI), located on the left side of the channel's mouth toward the Río de la Plata out of its own budget with some help from the coast guard.

The breakwater on the right side of the channel has a long history of private provision. It was built by the CNSI in 1915, over formally governmental property. The report from the club's board that year says:

The building of a breakwater was decided. The Board tried by all means to get national and provincial governmental support, supplying the needed rocks for this work, but it was impossible, and considering the small budget available it requested the transportation from some companies, though it had a hard time paying for the material.

Finally, thanks to the gratitude of club member Arturo O'Connor, who sold the rocks at cost, paying taxes himself and also labor, we got 435 tons to proceed with the work. (CNSI 2011; translated by Krause)

Dredging of the channel was started thanks to the donation of a boat by the local government and pumps from an importing company. UNEN later built a beacon at the mouth of the channel. Neglect by the government and dredging by the club has continued for almost 100 years, eventually with partial support from the coast guard (Prefectura).

V. Conclusion

The debate over lighthouses has become a central feature of economic theory. It addresses the features of different assignments of property rights and what kind of institutional setting may be able to supply services characterized by limitations to exclude nonpayers and the potential of free-riding.

Such settings must address issues of financing and provision, and it has usually been considered that feasible options ranged from categories 3 to 5 in terms of van Zandt's classification; that is, ranging from governmental financing and provision to government-mandated financing and private provision. Although several authors

have considered hypothetical solutions entailing private provision and financing, no such cases were thought to exist, and few have been mentioned from ancient times, where no much evidence was forthcoming.

The UNEN case brings a live example, the performance of which may be evaluated in the present and in the future. It fills the gap of historical cases for private provision and financing with only government enforcement of property and contractual rights (category 2). Despite being dismissed by many authors, it shows its feasibility—not perfect, of course, though better than previously existing settings. It adds one more case to a long list of privately provided public goods like neighborhood services (Stringham, Miller, and Clark 2010) and shows that economists look at this issue with a preconceived bias that solutions of this kind are not possible and, therefore, will not exist. But they do, as these cases show.

The question, of course, is how. How do voluntary actions overcome free riding and nonexcludability problems? One typical way is through entrepreneurial technological innovation and the institutional allowing of excludability and enforcement of property rights. The obvious examples are barbed wire for cattle and private neighborhoods for people. The legal system, though, should be receptive to these innovations. Economists should be, too, but their denial of private solutions contributes to limiting the options to governmental provision and financing only.

This case also opens some research questions for the future: does the free-rider problem need to be solved, or will the voluntary solution continue its present course? Will a new institutional setting come to replace the present system to prevent free riders? Or will a technological development do it? Will the present setting evolve toward more private property rights? Finally, how much of this private solution owes its existence to the complete failure of governmental provision?

UNEN financing and provision of navigational aids on the northern coast of the Río de la Plata bring to us a laboratory where the evolution of an institutional setting may be evaluated and the private provision of public goods is confirmed.

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