

Property Rights: Private or Public? Evidence from the Boston Frozen Water Trade

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Abstract

Many economists agree that markets work exceptionally well yet concede that this can only happen within the context of clearly defined property rights, which necessitates government action. This is false. Ice harvesters in 19th century Boston were able to create their own system of property rights that allowed each person around the pond to thicken ice as needed. In doing so, this paper contributes to a growing literature demonstrating not only that property rights can be provided privately, but that they serve the function of ideal state-provided property rights.

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I. Introduction

Imagine that you are living in Calcutta, India, in 1837 and a man with a thick Boston accent offers you some ice cream. There is no such device as a refrigerator, let alone a freezer, and yet here is this man offering you a cold (and delicious) treat. How did it get there? Economists rightfully trumpet the power of markets to allocate resources efficiently through the system of profit and loss. However, these same scholars will frequently concede that this is only possible within a world of defined and enforced property rights. In fact, most economics textbooks implicitly assume that property rights simply exist and proceed to discuss economic performance from that standpoint. In cases where property rights are unclear, they then take a god's-eye view in suggesting that this can be resolved with the

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Coase theorem in the event that transaction costs are low and by government deliberation in the event that transaction costs are high.

This, however, represents wishful thinking, as it asserts that government officials lacking the economic interest possess the knowledge of what the property rights regime ought to look like and that these officials have the incentive to enact the proper rules. Mises (1922), Hayek (1945), Buchanan & Tullock (1962), and Ostrom (1990) all speak to reject this claim on both grounds. Mises, Hayek and Ostrom demonstrate that only the individuals affected by the rules and their design hold the knowledge of what it is that needs to be done. Buchanan & Tullock analyze the incentives faced by politicians, whose primary interest is getting reelected.

This is problematic, as the very foundation of economic activity is being provided by a group of people who 1) lack the knowledge of what problems must be solved and 2) are interested in solving the problems at hand only if it will help them get reelected. One solution is to allow private individuals to create their own property rights regimes, as these people possess the knowledge of what problems need to be resolved and the incentive to resolve them as well as the cultural understanding, or what Boettke et al. refer to as the *metis* (Boettke, Coyne, and Leeson, 2008). This can be illustrated by looking at the rise of the frozen water trade between 1806 and 1840 in Boston, Massachusetts, where private individuals were able to create their own set of rules to govern access to frozen pond water.

Through the early 19th century, the only people who were able to enjoy the benefits of refrigeration were those that lived far enough from the equator that water would freeze naturally. Of those people, only the very wealthy could afford to have ice any appreciable time after the spring thaw. Ice, therefore, either did not exist or was barely more than a nuisance to the vast majority of the world. This began to change starting in 1806, when Frederic Tudor first set sail from Boston, Massachusetts, with a cargo of ice (Weightman, 2003). He was mocked and ridiculed during the preparations for his journey, but he persevered and demonstrated that ice could indeed be shipped from Boston to the Bahamas.¹

The following years saw a massive growth in the amount of ice shipped to the Bahamas and the rest of the world. Tudor's initial

¹ At one point, a local newspaper ran a story titled "No Joke, Ship Full of Ice Sets Sail for Martinique. Let's Hope This Doesn't Prove to be a Slippery Speculation!"

cargo in 1806 comprised only approximately 120 tons of ice. By the 1820s, the total amount of ice leaving Boston harbors was close to 3,000 tons, with 2,000 tons coming from Tudor's ice company alone (Cummings, 1949). By the 1850s, ice from Fresh Pond and the surrounding area could be found in Atlanta, London, New Orleans, India, South Africa, Australia, and every major island in the Bahamas. Within a span of only 50 years, almost all corners of the world were receiving ice from ponds in and around Boston.

The golden age of this industry lasted between 1818 and approximately 1875, with 1837 through 1860 representing the peak of this golden age (Cummings, 1949; Seaburg & Paterson, 2003; Weightman, 2003). It was during this time that the largest shipments of ice were going out to all corners of the world.² In a recent advertising campaign, Bacardi (maker of Dewar's) listed Tudor's ice innovations as the second most important event in scotch history.

To understand the history of this industry, I draw upon several historical documents made available to me at Harvard's Baker Library. This collection includes Frederic Tudor's *Ice House Diary*, which contains a firsthand account of the history of his efforts to sell ice in faraway lands. It also includes several letters sent by Tudor to various parties around the world. Further, it contains several notes regarding weather conditions throughout the years, the amount of ice shipped, and other various statistics. Unfortunately, the diary, while extensive, only contains sporadic entries between 1805 and 1837. Fortunately, the Massachusetts Historical Society has provided copies of other documents that help to fill in these gaps and shed light on the events post-1837. The firsthand account of Captain W. J. Lewis Parker, who captained a ship as a part of the comparable Norwegian ice trade, provides valuable insights as to how the ice was actually stored and shipped. Finally, the widely regarded as seminal work of Richard Cummings provided an invaluable account of many of the nuanced historical events in Boston during this particular time period. Subsequent refinement of this history by Gavin Weightman, Carl Seaburg, Stanley Paterson, and Philip Woods also aided in understanding the history of this industry.

² In fact, many places aside from Boston joined in the global frozen water industry. In 1850, for example, Norway began shipping ice to London. We also observe the people of Alaska shipping ice to Australia during one of their gold rushes, starting in about 1905.

The rest of the paper will proceed as follows. Section II describes the emergence of property rights governing ice on ponds in 19th century Boston and, in doing so, contributes to a growing literature on the private organization of rules (see Stringham, 2002; Coyne and Leeson, 2005; Leeson, 2005, 2006, 2008a, 2008b; Cole, 2007; Schaeffer, 2008). Section III details the effects these property rights had on the industry. Section IV provides policy implications of this research. Finally, Section V concludes.

II. Emergence of Property Rights Governing Ice

Prior to the rise of the frozen water industry, ice on sufficiently large ponds was held *res omnia*, i.e., for the common use, meaning that anyone could come to the pond at any time and harvest as much as ice as they wanted. This, however, began to change thanks to the efforts of Frederic Tudor and Nathaniel Wyeth, who revolutionized the industry through technological innovation.

When shipping ice long distances with the intent of selling it in tropical locations, one must be concerned with minimizing the ice lost to melting. Prior to 1806, icehouses were typically constructed as large, underground caverns to shield the ice from the sun.³ Underground icehouses may have worked well for a time, but they were extremely costly to construct and expand. In 1807, Tudor began experimenting with various techniques to build an aboveground icehouse. His design was simple: construct a building within a building and fill the spaces between with some type of insulation (see Figure 1). After experimenting with various materials, Tudor settled on sawdust, which worked well and was readily available from local lumber mills (Weightman, 2003, p. 48–49). These aboveground icehouses were much cheaper to build, maintain, and expand than their underground counterparts. This technology was also easily transferable to ships, as Tudor would later outfit all of his ships with a double-hull design that allowed him to insulate the ice from the heat.⁴

³ William Fletcher, for example, had maintained an ice depot in the basement of a furniture warehouse for years by 1806, which he used to sell ice to the people of Boston (Cummings, 1949, p. 3).

⁴ He also used clays/waxes to seal gaps between the boards on the deck and to seal the hatches to the cargo hold shut, effectively making them airtight. This prevented the warm air from getting below deck, further reducing the amount of ice lost to melting.

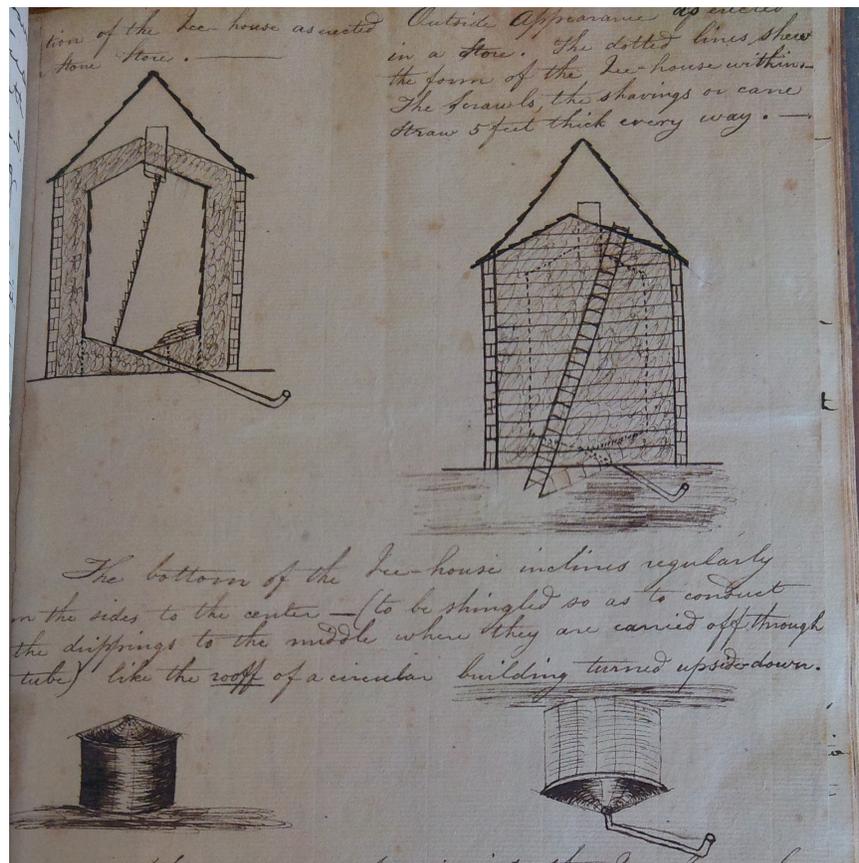


Figure 1: Tudor's sketch of an aboveground icehouse.

While Tudor focused on methods for insulating the ice, Wyeth focused on methods for harvesting the ice. Nathaniel Wyeth, the son of a hotel owner, cut the ice from Fresh Pond using a modified plow to score the ice in a uniform, crisscrossing pattern. Comparing these blocks to the hand-cut blocks of ice, it was clear that Wyeth's blocks could be cut more quickly and more consistently. Tudor marveled at this invention, noting that the blocks from his other suppliers would frequently shift during transport, knocking into each other and breaking apart. Wyeth's blocks, however, stayed firmly in place and better survived the journey from the icehouse to the ship. Wyeth went on to pioneer many other inventions for the ice industry. In 1826 he improved upon his plow idea and used old farm equipment and horses to pull a multi-bladed plow across the ice. This scored the ice much more quickly and even more uniformly than before. Once

the ice was sufficiently scored, it was relatively easy to use large metal poles with a wedge on the tip to separate the blocks. In 1827, Wyeth invented an elevator system to more easily get the ice from the pond into the icehouse; this was modified into a pull-chain type device two years later in 1829. All of these inventions helped reduce the cost of harvesting and warehousing the ice. Wyeth was so instrumental, in fact, that Tudor himself remarked about the rapid fall in the price of harvesting ice, which prior to 1825 was 30 cents per ton and only 10 cents after.

The effect on the industry was clear. Seeing the new profit opportunity, farmers from around the area flocked to Fresh Pond looking to harvest ice to provide a source of income during the winter months (Cummings 1949; Weightman, 2003). Absent some means to allocate the ice among the competing uses, there could be no significant specialization between those selling frozen water domestically and those selling internationally. The further the distance that was to be travelled, the thicker the blocks of ice that were desired, as thicker blocks of ice would thaw more slowly than an equal volume of smaller blocks of ice.⁵ Demsetz (1967) predicts that, as the value of an open-access resource rises, so too will the demand for a system of property rights. Ostrom (1990) further suggests that the people who are affected by the rules are the ones who possess the local knowledge of what the nature of the problem is and what solutions are likely to be the most productive. However, standing in the way of this process was the Colonial Ordinance of 1647, which stated that all Great Ponds⁶ were the property of the entire community so that everyone's rights to "fishing and fowling" could not be denied by any large landowner.

This changed on October 4, 1840, when a lawyer named Simon Greenleaf, who was hired by Wyeth, filed an indenture against the townsfolk to the Middlesex County Registry on the grounds that harvesting ice was not specifically listed as a protected activity under the Colonial Ordinance.⁷ The Registry granted his request, and the

⁵ Ice melts at a rate that is proportional to its surface area. One large block of ice has much less surface area than several smaller blocks that add up to the same volume. The remains true even if the smaller blocks are pushed close together, as air can still get between the blocks (Gosnell, 2005).

⁶ Classified as any pond greater than 10 acres in size.

⁷ Middlesex Registry, East Cambridge, Mass., MSS, Fresh Pond, Division of Land among Proprietors, October 4th, 1840.

people around the pond were free to establish clearly delineated property rights over the ice. This process was finalized after Greenleaf and his commission submitted an agreement to the office of the registrar of Middlesex County, which included a detailed map of Fresh Pond along with the agreed-upon property specifications on November 18, 1841.

The agreement reached appropriated ice to the shore owners according to how much of the shoreline they owned at the time of the map's drawing.⁸ Simply put, the more shoreline one owned, the more of a claim to the ice that could be made. The result was what some (Sinclair, 2009; Weightman, 2003) have referred to as a veritable spider web of property lines (see Figure 2). Under this arrangement, Tudor and Wyeth could lay claim to almost two-thirds of the ice on the pond between the two of them (Weightman, 2003).

III. Effect of the Establishment of Property Rights

With their new property rights, the harvesters around the pond could choose how thick to allow their ice to freeze depending on how far they were going to ship it. Tudor, for example, was able to allow his ice to thicken to better survive long journeys. Beginning in 1833, Tudor had begun selling ice in Calcutta, India. However, he found that the journey was much too long for his ice to survive the trip.⁹ With the system of property rights in place, Tudor was able to allow his ice to thicken naturally. In fact, not only was he able to do this, but he was also able to actively thicken his ice by cutting a sheet of ice out and sliding it underneath existing ice. The water between these two sheets of ice would then freeze together, creating one, thicker block of ice. This process could be repeated as much as desired, with Tudor noting in his diary at one point that he had harvested blocks of ice that were 22 inches thick when the water naturally froze to a thickness of only 4 inches. The securing of property rights led to a clear increase in the amount of ice that Tudor could ship to Calcutta, as shown in Table 1.

⁸ Some people around the pond attempted to game the system by digging canals into their property from the pond. These attempts were ignored by Greenleaf and his commission, and instead the shore of the pond was treated as if the canals were not there.

⁹ The Suez Canal was not completed until 1869, meaning that at this point sailing from Boston to India entailed sailing around the southern tip of Africa, which meant that the ship would have to cross the equator twice.



Figure 2: Map of the property lines on Fresh Pond.

Tudor was not the only person who benefitted from this arrangement. It also allowed shippers who focused on shipping ice to places such as Atlanta, Georgia, and New Orleans to harvest their ice earlier so as to maximize the quantity of ice that they could harvest from their share of the pond. Smaller landowners also benefitted from this arrangement. With only a small amount of land owned, the amount of ice that they could lay claim to was simply too small to justify constructing an icehouse. With divestible property rights, however, these parties were able to lease their claims to the ice to larger operations.

Finally, everyone around the pond benefitted greatly, as the value of their property rose almost immediately. According to a letter Frederic Tudor sent in 1848, he purchased land around Fresh Pond for \$130 per acre prior to 1840 and had recently turned down an offer of \$2,000 per acre (Weightman, 2003). This rapid rise in the value of real estate is indicative of the value that the property rights had created. In being able to purchase access to the pond, potential buyers were able to buy into a valuable revenue stream.

However, the people of Boston were not the only ones to benefit from this arrangement. For example, Edward Everett, writing in

Table 1: Annual Shipments to Calcutta

| Year | Tons Shipped to Calcutta | Year | Tons Shipped to Calcutta |
|------|--------------------------|------|--------------------------|
| 1833 | 201 | 1842 | 2,063 |
| 1834 | — ^a | 1843 | 1,620 |
| 1835 | 354 | 1844 | 3,320 ^b |
| 1836 | 671 | 1845 | 2,331 |
| 1837 | 910 | 1846 | 3,079 |
| 1838 | 613 | 1847 | 2,883 |
| 1839 | 2,536 ^c | 1848 | 3,266 |
| 1840 | 1,885 | 1849 | 3,434 |
| 1841 | 1,885 | 1850 | 3,107 |

^a In 1833, Tudor’s partner in the Calcutta ice trade, Samuel Austin, violated the terms of their contract, and so in 1834 Tudor sent him zero ice deliberately as a means of punishing him. He then sent a person to replace Austin who was much more faithful.

^b The spike in 1844 can be explained by the construction of a new stone icehouse of massive proportions specifically for Tudor. He shipped extra ice on this occasion to stock this new icehouse.

^c 1839 represented the first year that Tudor sent extra ice to Calcutta with the intention of using some to preserve fruits and spices for a return voyage. This venture was not very successful, as the melting ice rotted the cargo.

Hunt’s Magazine (1855), reports on the gratitude the people of India felt for the ice that Tudor shipped them. Everett spent time in India, where he met what he described as a “wealthy, turbaned Hindu” whospoke at length about how wonderful America was for giving India such a precious gift. He writes:

At first I did not know what he referred to; I thought he might have in view the mission schools, knowing, as I did, that he himself had done a great deal for education. He immediately said that he referred to the cargoes of ice sent from America to India; conducing not only to comfort, but health; adding that numerous lives were saved every year by applying lumps of American ice to the head of the patient in cases of high fever. He asked me if I knew from what part of America it came. It gave me great pleasure to tell him that I lived, when at home, within a short distance of the spot from which it was brought.

I must say that I almost envied Mr. Tudor the honest satisfaction which he could not but feel in reflecting that he had been able to stretch out an arm of benevolence from the other side of the glove, by which he was every year raising up his fellows from the verge of the grave. How few of all foreigners who have entered India, from the time of Sesostris to Alexander the Great to the present time, can say as much!

With an increased ability to ship ice came an increased ability of consumers to satisfy lower-ranked wants. In this case, the people of India were able to use the ice not only as a means to chill drinks, make ice creams, or better preserve food, but also for medicinal purposes.

IV. Policy Implications

The policy implications from this research are clear. First is the notion that self-government can thrive only when people are allowed to govern themselves. Prior to 1840, the Colonial Ordinance of 1647 effectively prevented the establishment of rules governing access to the ice on the ponds. As the value of the ice rose, we observed entry into the market on the part of entrepreneurs. Absent a system of property rights, leaving ice on a pond to freeze thicker would result in another person harvesting the ice instead, as Hardin (1968) describes. With the rise of the property rights, however, each person was able to choose, if they wanted, to leave the ice on the pond to allow it to freeze thicker without fear of it being expropriated.

Second, in allowing the people around the pond to create their own property rights regime, the local government acted in a way that promoted competition and entrepreneurship. With the incentive to husband resources rather than harvest them as quickly as possible, which Hardin (1968) describes as being a “tragedy of the commons,” comes the ability to consider long-run profits as opposed to short-term ones. Long-run profits require investments in some form of capital. In this case, the capital that was being invested in was a means to further thicken the ice. With the ability to let the ice freeze thicker without fear of it being expropriated, interested parties could go one step further and develop techniques to thicken the ice past the point that it would naturally freeze to by sliding a section of ice underneath other ice. Allowing these two sheets of ice to freeze together produced thicker blocks. This process could be repeated as

desired, at one point producing ice nearly two feet thick. This ability to invest in ice was key for economic growth and development.

Finally, and related to the first implication, is the idea that local knowledge is critical for getting the institutions right. As Elinor Ostrom says, "... getting the institutions right' is a difficult, time-consuming, and conflict-invoking process. It is a process that requires reliable information about time and place variables as well as a broad repertoire of culturally acceptable rules" (Ostrom, 1990, p. 14). She continues, noting in the case of Turkish fishermen that "central-government officials could not have crafted such a set of rules without assigning a full-time staff to work (actually fish) in the area for an extended period of time...mapping this set of fishing sites, such that one boat's fishing activities would not reduce the migration of fish to other locations, would have been a daunting challenge had it not been for the extensive time-and-place information" of the local fishermen (p. 20).

However, the benefits of allowing people to govern themselves extend not only to those parties directly involved in the form of increased profits and employment but also to the parties indirectly involved; namely the customers. Allowing the people around Fresh Pond to solve the problem of overharvesting themselves allowed them to find new and valuable ways to serve their customers. In doing so, the lives of people around the world who bought the ice were necessarily improved and, in some cases, saved.

V. Conclusion

The frozen water trade of Boston, Massachusetts, provides a unique opportunity to study the emergence of property rights to govern access to a resource. Thanks to the efforts of Frederic Tudor and Nathaniel Wyeth, an entire industry was born, one that would last for nearly a century until the invention of artificial icemakers. The frozen water of Boston found its way to nearly all corners of the world. Perhaps no man said it better than Henry David Thoreau, when he wrote about ice from Wenham Lake (a lake not far from Fresh Pond), saying that "the pure Walden water is mingled with the sacred water of the Ganges" (Thoreau, 1910, p. 394).

To accomplish this amazing feat required vast technological innovations. Tudor's invention of the aboveground icehouse and Wyeth's redeployment of farm equipment to more quickly and effectively cut the ice on the ponds represented a radical change in

the production technologies of frozen water. However, these innovations could only take the industry so far. What was needed was a form of property rights specifying who had a claim to what ice as it lay on the pond. Thanks to Simon Greenleaf, this was accomplished. These property rights allowed the men around the pond to let the ice thicken naturally and also gave them the incentive to find new ways to artificially thicken the ice, which produced benefits for the Boston-based producers of the ice as well as the globally based customers.

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