Student Section

The Value of Water

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Introduction

Water scarcity and allocation issues are likely to grow with population pressures and environmental conditions, and with shifts in consumer preferences. To address these issues, determining the total economic value (TEV) of water resources can help optimize its allocation. The TEV of water is derived from the direct use of water (consumptive and non-consumptive) and the nonuse value of water. Consumptive and non-consumptive uses of water include agriculture and recreation, respectively, and nonuse values are determined from the uses of water as an intermediary, such as in hydroelectricity. Water's numerous uses in different markets result in a large variation in how it is valued. In some cases, values can be directly priced or capitalized, while other markets find it more difficult to do so; because of which, policymakers often find it difficult to optimize water use. This allocation optimization is further exacerbated by the tradeoffs which are difficult to characterize when water values differ.

As previously mentioned, the value of water can be classified into two values: consumptive and non-consumptive. Consumptive values are determined by water being diverted or removed from the landscape, such as agriculture or manufacturing, while non-consumptive values keep the water within the landscape. Despite sounding like opposites, consumptive and non-consumptive values do not have to be mutually exclusive, i.e. water being used for watering lawns will eventually be returned to surface or groundwater. The largest consumptive use of water in the United States is agriculture; specifically, the irrigation of crops in the West because of its more arid climate. This results in vastly different property rights and water-use institutions between the West and the East. Though agriculture is incredibly important to the economy of the United States, the non-consumptive values of water are equally important. Water-based recreation such as birdwatching, fishing, boating, and whitewater sports all depend on the availability of water and are directly affected by stream flow and riparian ecosystem health. Landscape water is also important in the maintenance of ecosystems, where they provide erosion regulation, nutrient recycling, and other services.

While these values are not always mutually exclusive, they are frequently in conflict, resulting in the existence of tradeoffs. In Western states, water rights are mostly governed by prior appropriation, often meaning that agricultural producers have the most senior water rights. While this is not necessarily a negative, agricultural producers may not see an incentive to allow those downstream to use their water, therefore cutting them off; or the water they do allow to flow downstream is of poor quality. Thankfully, states often have river

flow regulations and agencies which study the impacts of streamflow and set policies which set acceptable flow levels for environmental protection. For example, the California Water Board (CWB) works with the California Department of Fish and Wildlife (CDFW) to determine appropriate flows for wildlife before appropriation decisions are made. Recently, market-based solutions are being used to alleviate conflicts by allowing the trading and selling of water rights. While theoretically promising, these solutions face practical limitations. These sort of decisions and policies are only effective when water can be transferred via property rights, institutions, and water infrastructure. The question then becomes, "*How do we value, or estimate the value, of water*?". To address these allocation challenges, economists use various methods to estimate water's value.

Water Value Estimation

Unlike private goods and services which are bought and sold in markets, environmental and natural resources are not always valued within markets and often do not have well-defined property rights. There are many methods used to value natural resources, with the most commonly employed methods being revealed preference and stated preference. Revealed preference methods use observed behavior and is often used to value the direct use of water in agriculture and industry; it can also be used to measure nonconsumptive values based on the market for related goods. The two most common revealed preference methods are the hedonic price method and the travel cost method – the hedonic method uses prices from sales of land/property, while the travel cost method uses the costs (e.g., opportunity cost of time, gas) to visit a site along with their number of trips to determine their willingness to pay. Stated preference methods estimate value through means such as surveys, focus groups, or experiments. Two often-used stated preference methods are contingent valuation and choice experiments, both of which present a hypothetical scenario to respondents.

Use Value of Water

There are two primary use values of water: its use value in agriculture and its use value in the environment. Water is an incredibly important input for agriculture, with it being used for irrigation and livestock watering, among other things. As droughts become more frequent and demand increases in other sectors, understanding the value of water use and access for agriculture can help provide policymakers with important information they need when looking at water resource allocation. The literature attempting to understand the value of water in agriculture has used both revealed preference and stated preference methods. Regardless of which method type is used, the literature indicates that land close to sources of water – lakes, streams, aquifers, aqueducts – and already established irrigation systems tend to sell for more than land further away from water or lacking irrigation systems. The environmental use of water is often studied through the lens of recreation due to the relative ease of establishing surveys or acquiring visitation data. A unique opportunity provided

through environmental use values is that multi-use lakes and reservoirs can provide comparative values across different sectors. One such study conducted by Cordell and Bergstrom (1993) showed that maintaining high water levels in the summer and fall was positively correlated with increases in recreational value; however, this resulted in less power generation from the Tennessee Valley Authority. In terms of monetary value, this suggests that although recreational values may be significant or see increases with more water present, diverting water to other uses may be equally sensible.

Nonuse Value of Water

Water has value outside of both recreation and agriculture – it provides habitats for local flora and fauna and can also provide cultural services. River restoration in the Western United States can also provide monetary benefits, though they would not be immediately observable. One such example is the removal of some of the many dams that litter many of the rivers in California, Washington, and Oregon. Restoring their natural flow will benefit those who use its water downstream but also benefit migrating salmon who use the river to access their spawning grounds upstream.

Conclusion

Understanding the value of water is important as it allows politicians and policymakers who allocate water to better understand its best suited use. Although water is incredibly important for the private sector, such as agriculture and manufacturing, it's also incredibly important to the public sector, whether it is being used for recreation during the summer or providing habitats for wildlife. The value of water can be calculated through methods such as the revealed preference method and the stated preference method. In the agricultural sector, water is an incredibly important input whose contribution towards increased harvest is shown through the water prices paid during times of drought, and the price of land which borders or has within it a body of water. In recreation, water levels of rivers, reservoirs, and lakes directly affects visitation rates – when there is too little water, visitation decreases, and when there's too much, the benefits become marginal. Future research should focus on integrating ecological and economic values to guide sustainable water policy.

Works Cited

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