1. Introduction

This study explores the economic effects arising from TVA lake-management policy on several lakes located in the eastern portion of Tennessee. It is an outgrowth of public pressures within the region for a re-consideration of lake-management policy that would allow lake levels to remain at or near full pool through August and September of each year. The research reported here was funded by a grant from the U.S. Department of Housing and Urban Development. This introduction defines the scope of the research, reviews the methodologies used to estimate economic effects and provides an overview of the structure of the study.

Economic Effects of TVA Lake Management Policy

TVA has multiple policy objectives including power generation, navigation, flood control, environmental stewardship and economic development. In practice these objectives may be in conflict with one another, so TVA must engage in a balancing act in setting goals and implementing policy. TVA itself recognizes the need to balance the competing uses of the resources it manages. The U.S. General Accounting Office has explicitly noted that “In operating these projects, TVA faces a balancing act of how to maximize the benefits of the available water to meet all purposes. TVA’s ability to lower and raise the lake levels during the year is a key element in this balancing act” (U.S. GAO).

Priorities have changed over time as the region has developed and as the benefits and costs of different uses of water resources have changed. TVA policy has changed and further changes may be forthcoming in response to this study and the ongoing Reservoir Operations Study (ROS) being conducted by TVA. But the changes have not always been to the complete satisfaction of stakeholders in the region. A case in point is the problem addressed in this study: the economic consequences of lake-management policy in East Tennessee. Numerous recreators and many residents on and near the various reservoirs maintained by TVA would like to see higher pools through fall and into winter — if not all year long — to support recreation and quality aesthetic views. In light of the weak economic base in many parts of the East Tennessee region (see Section 2 of this report), enhanced recreation activity could prove to be an important complementary source of job creation and tax base expansion. Also important are improvements in aesthetic views, greater accessibility to water and increased lake acreage that can enhance the quality of recreation experiences and enhance property values for residents. So there remain pressures to shift the balance further. These pressures will likely mount as the region develops further and as more people live on and make use of the area lakes.
TVAs argues that a policy change in support of delayed drawdowns may compromise flood control, lead to a deterioration in water quality and limit power generation absent new investments in productive capacity. To TVAs credit, there have been some changes to lake management policy over time. Notable was the shift in policy in the early 1970s that allowed for higher winter pools on some lakes and the policy change in the early 1990s that led to a delayed drawdown from Memorial Day to August 1. Many residents on or near TVA managed water systems would like to see further changes made to lake management policy in order to increase recreation benefits, property values and quality of life. Based on a survey of recreators conducted in 2002 (see section 3 below) two-thirds of the Tennessee respondents indicated a willingness to pay more for electricity to enjoy higher lake levels and 57 percent said they would be willing to take more trips during August and September. Well over half of homeowners surveyed on Douglas and Cherokee lakes as part of this project (again, see below) indicated a willingness to pay for higher lake levels.

The tradeoffs and challenges confronting TVA policymakers and area residents are not unique. The following three examples place the regional problem in a broader national context.

- Concerns have surfaced in the region of Cooper Lake Texas, a lake recently developed by the U.S. Army Corps of Engineers, over how lake-level variation will hamper residential development and tourism activity.

- In order to help guide lake management policy on Lake Almanor (California), Pacific Gas and Electric Company recently completed a study examining, among other things, recreational effects and property value effects arising from variations in lake levels. Significant effects were identified for both recreation and property values. For example, an additional one-foot fall from the summer minimum pool means a 2.5 percent reduction in the selling price of a home in the same year.

- The Lower Colorado River Authority was established in 1954 to manage water in central Texas. Competing uses of the river region include recreation and rice production. A 1994 study by the Corps of Engineers showed that recreation spending on Travis Lake was reduced by almost 50 percent while Buchanan Lake saw a one-third reduction in recreation spending due to increased drawdown of lakes. A new study has been commissioned to examine the economic consequences of the drawdown policy and support an assessment of possible policy changes.
Table 1.1 provides an illustration of the drawdown policy for seven lakes in East Tennessee for the period of June to September 30. (The drawdown that ensues into winter leads to a much sharper reduction in lake levels on most of these lakes.) Aside from Ft. Patrick Henry Lake which experiences little water level variation, Boone and Watauga experience the most modest reductions in levels, while Cherokee and Douglas experience larger level reductions of 24 feet. Based on lake-bottom topography these vertical drops in lake levels lead to differential impacts in terms of the extent of shoreline exposed. Hence different recreation activities and residential properties will face different effects from drawdowns.

The primary economic effects of lake drawdowns are reduced recreation spending, reduced value (i.e., personal satisfaction) from the recreation experience, and reduced property values that arise from limits on lake access and from a deterioration in the quality of scenic views. Some of these impacts affect regional wellbeing, while others may affect national welfare. These effects are the focus of this report. Specifically the project is intended to offer guidance on the economic consequences of changes in lake management policy that would extend full pool until the end of August or the end of September of each year on seven East Tennessee lakes (see Table 1.1).1 The study provides estimates of economic impact, or the benefits that accrue from recreation-related spending within the region, as well as estimates of economic value, i.e., the intrinsic value that would be created for recreators and homeowners from higher lake levels. The study does not address changes in power generation costs and flood control risks, nor the way in which changes in lake levels on the seven lakes considered here translate into changes elsewhere in the TVA system. For example, maintaining higher pools on these lakes may require additional generation capacity to meet peak demand, an increased flood risk for downstream residents and businesses and potentially lower pools for other lakes that give rise to negative economic effects. A complete analysis is required that examines the full set of

Table 1.1. Fall in Lake Levels, June to September 30th

<table>
<thead>
<tr>
<th>Lake</th>
<th>Approximate Fall in Level (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boone</td>
<td>6</td>
</tr>
<tr>
<td>Cherokee</td>
<td>24</td>
</tr>
<tr>
<td>Douglas</td>
<td>24</td>
</tr>
<tr>
<td>Ft. Patrick Henry</td>
<td>--</td>
</tr>
<tr>
<td>Norris</td>
<td>21</td>
</tr>
<tr>
<td>South Holston</td>
<td>21</td>
</tr>
<tr>
<td>Watauga</td>
<td>16</td>
</tr>
</tbody>
</table>

Source: Based on lake guide curves produced by Tennessee Valley Authority.

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1In practice, the work reported here is confined to only 6 lakes, excluding Ft. Patrick Henry due to the lack of water variation on this lake. Fontana Lake and Swain County, North Carolina are beyond the scope of the HUD grant that funded this research. However, estimates of economic effects for Fontana Lake are available from a parallel study that has been recently completed. These estimates are reported below.
benefits, costs and tradeoffs confronting TVA that influence national and regional wellbeing. Hopefully this will be the outcome of TVA’s ROS to be released in 2003. The estimates presented here on economic impact and economic value should prove useful to TVA and those in the East Tennessee region as policy deliberations move forward on how to balance uses of the regional watershed.

**Regional Versus National Perspectives on Economic Effects**

Economic effects can be analyzed from both a regional and national perspective. Economic impact analysis is the methodology commonly employed to examine economic gains and losses for regional economies. Evaluating economic gains and losses for the nation requires a different approach that captures changes in individual wellbeing, something that cannot be measured simply by tracing the flow of dollars through the economy. Both approaches are discussed here in turn.

**Economic Impact Analysis**

Regional stakeholders are particularly interested in the economic consequences of lake level management policy for their region of residency. Regional economic effects are typically measured using the tools of *economic impact analysis* (EIA) which capture the way in which spending ripples through an economy creating jobs and income, and expanding tax bases. (Appendix A provides a brief overview of the EIA methodology.) Economic impact analysis is often used to examine the consequences of changes in industrial or business activity on a regional economy. The region is viewed as the exporter of industrial products, and sales to those outside the region lead to a net increase in jobs and income for the producing region. Similarly, EIA has been used extensively to estimate the economic effects arising from changes in recreation and tourism activity. In this case the out-of-region tourist is the source of new spending for the region. For example, a study was completed in 1998 for Land Owners and Users of Douglas Lake that relied on this methodology; Cordell et al. (1990) used similar methods to estimate the effects of lake-level management policy on Fontana Lake for a region of western North Carolina.

It is important to distinguish between economic benefits that accrue to a region of the national economy versus an increase in benefits for the nation as a whole. In many instances the activity explored through the tools of EIA, like the location of a large industrial facility, represents a zero-sum game for the nation, while imparting significant new benefits to a single region. From the nation’s perspective it is irrelevant where the industrial firm chooses to locate; regardless of its location, roughly the same number of jobs and the same amount of income will be generated. But the same industrial firm certainly offers significant benefits to its host community as the jobs and income would be lost.

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should the company locate elsewhere. So the firm’s location represents a zero-sum game for the nation but a positive-sum game for the region of location.

Recreation spending is no different than the expenditures of the industrial firm that give rise to job and income creation. A simple reallocation of recreation spending across regions of the nation — from one park to another, from one tourism attraction to another — may lead to no net gains to the national economy. But again, one region can benefit significantly from an increase in recreation activity, although this may come at the expense of another recreation site. Similarly within a given region, changes in the allocation of recreation spending may lead to no net gain for the region. In the current context, should local recreation activity increase on the part of local residents in the face of higher lake levels, there is no gain in national economic activity and likely no gain in activity for the lake region itself. The reason is that recreators may simply change the mix of in-region recreation spending. Should local residents choose to spend within the region as opposed to spend outside the region in the face of higher lake levels, the local economy would benefit but there would still be no increase in national economic activity.

Retiree spending is analogous to recreation spending from this perspective. That is, insofar as retirees will choose to live somewhere in the U.S., it is of no real consequence for the nation which state of residency they choose. As retirees move from one community to another, national economic activity is unchanged while regional economic fortunes shift as one region gains at another region’s expense.

Regional economic impacts remain highly relevant from the perspective of the region that makes decisions and invests resources to enhance its own welfare. Residents, as well as state and local governments, are rightly concerned about the gains and losses that may be experienced through the economic development process. Economic impact analysis can help identify potential gains for a region, guide resource allocation (like incentives to attract economic activity) and facilitate policymaking. It is always important to examine economic benefits and economic costs in order to properly guide policy. For example, while recreation and retirees may represent a source of economic benefits for the region, both visitors and residents require public services and infrastructure that can be costly. Moreover, economic growth can lead to congestion and changes in quality of life that should be identified. While TVA confronts a balancing act in managing the water resources of the Valley, residents and policymakers confront a different yet equally important balancing act in promoting economic development for a region.
Economic impacts arising from recreation are often measured through the use of surveys. This is the approach followed by this study. As discussed more fully below, surveys were administered to recreators and households in the region to identify lake-related expenditures. The expenditure information is in turn used to estimate job and income gains for the state and for the region surrounding the lakes. Emphasis is placed on net economic impacts, i.e., the impacts that accrue to the region from spending which comes from outside the region. Nonetheless, gross impacts, or the benefits from all recreation spending, are also estimated and reported.

**Economic Value Analysis**

Of ultimate interest from a national perspective is improvement in economic wellbeing or economic value. Economic value is not the same as expenditures, income or jobs. Value is instead psychic wellbeing and accurs through the use of a product or a resource, like taking a recreation trip; it is what someone is willing to pay to purchase a good or service above and beyond the cost to producers of supplying the good or service. Increased value means people are willing to pay more to buy and consume something; increased willingness to pay is a reflection of increased value. In the current context, if lake levels could be increased in late summer and early fall, value and willingness to pay would likely increase on the part of many recreators and many homeowners. As a result, recreators and homeowners would enjoy greater value through increased use and improved view quality. Note that for homeowners and recreators alike there may be no economic impact from this policy change as discussed above, i.e., no increased spending, no new jobs and no new income, but there may still be an increase in net economic value. Cordell at al. (1990) estimated a $14 million gain in economic value (in 1988 dollars) should Chatuge, Santeelah, Fontana and Hiwassee lakes be maintained near full pool through October 10th of each year.

The federal government has offered guidelines on how to conduct economic assessments of federal water projects. A primary source is the 1983 report of the U.S. Water Resource Council (*Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies*); similar principles are embraced in the 1993 guidelines of the U.S. Army Corps of Engineers (*National Economic Development Costs*). For the application to East Tennessee, these guidelines call for an assessment of how changes in lake levels will affect economic value for the national economy. Economic impacts, as discussed above, are not necessarily relevant to the identification of economic value. Increased economic value for recreators and households from higher lake levels must then be compared to any losses in economic value elsewhere in the TVA system. Stewart, Kahn and Jakus prepared a report for TVA that provides

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3Existence value is not considered here. For example, people may place a value on a resource like a national park or an animal species even if they never visit the park nor see the animal; value accrues simply through existence.
broader coverage of various concepts of value as they relate to evaluation of TVA river operations.

In practice, estimation of economic value is problematic in part because some of the “goods” consumed are not formally purchased or traded in the marketplace. For example, neither “recreation” nor “scenic views” are directly or explicitly purchased. Researchers fall back on two general approaches to estimating economic value: the stated preference approach and the revealed preference approach. Under the stated preference approach, a researcher simply asks someone about their contingent behavior: What would you be willing to pay to enjoy higher lake levels? This “as if” approach has been widely criticized since there is no way to verify behavior and respondents have an incentive to overstate the benefits (or in other contexts the costs) of policy changes. At the same time, the stated preference approach allows consideration and evaluation of behavioral responses that are otherwise impossible to capture. In the current context, TVA has never delayed the drawdowns on East Tennessee lakes, and thus there is no way to observe how behavior may change in response to a policy change. The estimates presented in this report include measures of economic value based on standard contingent valuation questions, as well as the more sophisticated tools of conjoint analysis. Conjoint analysis, which is discussed more completely below, does not as easily lend itself to respondent manipulation.

Researchers prefer to make estimates of value based on revealed preferences, or in other words, actual as opposed to hypothetical behavior. But when it comes to environmental amenities for which there are no markets, this can be difficult in practice. This study makes use of one revealed preference technique, the hedonic price model (HPM), to estimate the value of different lake levels on property value. While access to a lake and the quality of a view are not directly purchased with the home, these attributes are certainly bundled with the home and are thus implicitly reflected in home value. Just as one would expect a home near a landfill to have lower value than a similar home elsewhere, one also would expect a lakefront home with a good view and good lake access to enjoy a price premium. Using a sample of properties on Douglas and Cherokee lakes, estimates are made of how variations in lake levels affect property values. This provides a basis for estimates of the property value benefits of a delayed drawdown.

A Roadmap of What Is to Come

The remainder of the report is organized as follows. The first section below provides a socioeconomic overview of the lake region that is the focus of this report. The next section provides background and summary statistics on the surveys of recreators and households that were used to estimate economic impacts and economic value. Economic impact estimates are then presented for the lake
region that is the primary focus of this study, as well as for the state economy. The economic impact estimates reflect the benefits that would accrue from maintaining full pool on the East Tennessee reservoirs to September 1 and to October 1 of each year. The final major section of the report offers estimates of economic value associated with a delayed drawdown. The economic value estimates reflect benefits for recreators and homeowners from a delayed drawdown. The report closes with a brief summary of findings.