

Water value, resource rent recovery and economic welfare cost of environmental protection: A water-sector model for the Steelpoort sub-basin in South Africa

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Abstract

This study developed an analytical framework and an empirical water sector model to evaluate current and alternative water allocation regimes in the Steelpoort sub-basin (SPSB) in terms of the key objectives of the national water act of South Africa. The analyses showed that bulk water is currently not only oversupplied to offstream uses in the SPSB at the expense of the ecological Reserve (instream benefits) but also underpriced. The water research levy, the only mechanism used for rent capture, recovers a negligible proportion of the water resource rent (RR) (less than 2% at best) implying that almost all RR dissipates to various offstream users in the form of indirect subsidies of about R0.42/m³ with the more realistic low-price elasticity assumption. Commercial irrigation enjoys the highest subsidy being the major consumer followed by mining and hence the most to be affected by policy change in this regard. Results also indicate that the total maximum economic value offstream users are willing to pay for increasing water yields to supply the full requirement levels currently enjoyed at the SPSB is estimated at about R2.8/ m³. Although this value does not properly measure the net social gain or loss of environmental protection, it serves as a benchmark value against which per unit costs of potential alternative water supply options can be compared. A few caveats remain as key limitations of the study call for further research work. First, this study did not generate information on instream benefits to compare with offstream values lost as a result of protecting the ecological Reserve. Second, the study can benefit from improved specification of the water sector model parameters, particularly the supply side as better information will allow estimation of an upward sloping supply (marginal cost) curve.

Keywords: water value, resource rent and subsidies, water sector model, price elasticity of demand

Introduction

Protection of basic human and ecological needs, economic efficiency and social equity are the most important pillars guiding water resource allocation and use under the new National Water Act (NWA) of South Africa (SA). The NWA promotes integrated and decentralised water resource management under a new institutional environment. New management entities (catchment management agencies – CMAs and water user associations - WUAs) are currently established at regional and local levels, emphasising a largely decentralised and participatory approach to water resource management (Hamann and O’Riordan, 2000; Perret, 2002). The decision-making process for water management in SA therefore involves dealing with a complex system of interactions between multiple biophysical and socio-economic needs co-existing in a watershed. This process must also comply with and serve the economic efficiency, social equity, and environmental sustainability objectives of the NWA. Management and control of water demand has been identified as a major task of the newly established CMAs. The approach adopted for water allocation to economic uses relies on a licensing process through which water use authorisations are granted to various applicants. This process involves addressing a number of key questions such as establishing priorities and appropriate

regimes for allocation of water between competing uses (Farolfi and Perret, 2002).

However, water allocation decisions are currently made on the basis of very limited information on the behavioural structure underlying the decentralised decisions of the many water users involved. Proper modelling and adequate understanding of the motivations and rules that govern the choices of individual decision makers will provide better guidance for more informed water allocation regimes and policies centrally made by water management agencies. Decision support tools that can integrate in one framework the ecological and socio-economic dimensions of water resource use are accordingly needed to facilitate the design and implementation of water management strategies. This study develops a partial equilibrium water sector model to assist water managers and policy makers in SA design and evaluate alternative water allocation strategies. The Steelpoort area, a sub-basin of the Olifants River catchment in the north-east of SA, where a water stress situation exists as total annual water requirements exceed available yield and the deficit is currently supplied at the expense of the ecological Reserve was chosen as the case study area. The sub-basin is accordingly under pressure for preparation of a water management plan that would alleviate the current stress on the Reserve component, improve the economic efficiency of water use and meet the objective of social equity in water allocation.

The developed model extends earlier work on action research and watershed analyses for resource and economic sustainability-AWARE (Farolfi and Hassan, 2003) to explore the impact of different strategies of water allocation on the key objectives of the

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