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The cost of non-cooperation in river basin management: the cases of the Nile and the Zambezi basins

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In recent years there has been a renewed interest for water supply enhancement strategies in order to deal with the exploding demand in some regions, particularly in Asia and Africa. Within such strategies, reservoirs, especially multipurpose ones, are expected to play a key role in enhancing water security. In Africa alone, where the average per capita storage is about 50 m3 to be compared to 3500 m3 in the US, river basin development programs involving the construction of hydraulic infrastructures are on the way. This renewed impetus for the traditional supply-side approach to water management may indeed contribute to socio-economic development and poverty reduction if the planning process considers the lessons learned from the past, which led to recommendations by the World Commission on Dams and other relevant policy initiatives. More specifically, the issues dealing with benefit sharing, with the efficient and equitable utilization of water resources are key elements towards the successful development of those river basins. More attention should also be paid to the more mundane operational aspects once the infrastructures are on-line, as some deficiencies in planning can still be remediated by appropriate (re)operation, especially under changing hydrologic conditions (due for example to climate change) and societal objectives (e.g. growing importance of ecological preservation). Hence, on both strategic planning and operational levels, there is a need for improved coordination and cooperation among water users, sectors and riparian countries. However, few studies have explicitly tried to quantify, in monetary terms, the economic costs of non-cooperation, which we believe to be important information for water managers and policy makers, especially at a time when major developments are planned. In this paper, we propose a methodology to assess the economic costs of non-cooperation when planning and/or operating large-scale water resources systems involving multiple reservoirs, and where the dominant uses are hydropower generation and irrigated agriculture. Other uses such as environmental flows can be easily incorporated. The cost of non-cooperation is defined here as the short-run opportunity costs associated with unilateral developments. It provides a lower bound to the true cost of non-cooperation as investment costs are considered as sunk and ignored. To assess this cost, one needs allocation policies and marginal water values at various sites throughout the river basin. This information can nowadays be obtained from integrated modeling techniques, which combine hydrologic and economic processes in a consistent model. A comparison between the Nile and the Zambezi, two of the largest river basins in Africa, is carried out. For both basins a standard optimization run in which irrigated agriculture has priority is compared to an optimization run where water is allocated to its most productive uses. Some common features emerge: In the upstream, water for electricity production has a high marginal value in contrast to the lower value of agricultural water, which is lost to downstream power generation due to evapotranspiration. The cost of non-cooperation is larger in dry years, where it can be substantial, while in average years it is on the order of magnitude of a few percent of the value of energy production.