Modeling efficiency, equity and externality in the Eastern Nile River Basin

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Introduction

The process of allocating water from international water bodies (such as rivers, lakes and aquifers) that are shared by two or more riparian countries focuses on reaching a basin-wide agreement (treaty). Such agreement guides a resolution of likely conflicts and serves as a basis for collaboration over basin water allocation and management (e.g., investment and benefit-sharing). International organizations and development agencies frequently advocate basin-wide agreements as a means to utilize trans-boundary water resources. As a result, some riparian countries manage these resources through basin-wide agreements.

One challenge in such agreements is that efficient water allocation may not always be guaranteed, due to free-riding and asymmetric information among riparian countries. As a consequence, inefficient consumptive (mainly irrigation) and non-consumptive (hydropower) use of water, as well as loss due to seepage and evaporation, are typical outcomes in managing water resources. Moreover, water allocation through basin-wide agreement is based on the assumption that water in a river is a non-depletable resource, which ignores externalities and the impacts of climate change. Hence, almost all international or regional agreements assume that water management practices by each riparian country remain as in the status quo stage, without assessing whether or not the management practice is sufficient to sustain current and future resource use. By not fully addressing possible changes in the basin system and potential damages from riparian water use practices, the overall basin’s welfare is hampered, and water is not utilized efficiently and equitably.

The situation is worse in river basins that do not have basin-wide agreements on water allocation and basin management. In this case, water allocation among riparian countries is the result of factors such as colonial and Cold War legacies, property rights issues, national interests, prior uses and political and diplomatic influences. A typical river in this regard is the Nile. Accordingly, Nile River water allocations are based on political dominance, military strength and financial superiority, with little or no regard to efficient allocation of water and the impacts of negative externalities on the resource base.

Thus far, sharing the Nile has been a zero-sum game between upstream and downstream riparian countries: the downstream riparians fully utilize while the upstream riparians are deprived from utilizing Nile water. A decade-long international effort, through the Nile Basin Initiative (NBI) to establish a regional water institution is still unaccomplished. As a result, the Nile River basin has faced a challenge in the management of the river system. Alternative allocation/management approaches could address such challenges.
Allocate-and-Trade

Along with the basin-wide agreement, an intrabasin water trade, based on the principle of “allocate-and-trade” has been proposed for the Eastern Nile Basin riparian countries consisting of Ethiopia, Sudan and Egypt. The main objectives of this principle are to attain economic efficiency, address equity and maintain environmental sustainability. The basic notion of “allocate-and-trade” is that a basin institution will assign water rights to the riparian countries, monitor and evaluate the performance of each riparian country and, then, facilitate an intrabasin water trade.

The concept of Allocate-and-Trade was simulated against the proposed allocation arrangements in the literature and was found much more efficient and equitable than all the others. One important finding is that no matter what the initial water right allocation, the Allocate-and-Trade mechanism would lead to a highly efficient and equitable distribution of benefits.

Allocate-and-trade also internalizes the cost of resource degradation into water trade and estimates that riparian countries could raise about 660 million per annum for protecting and conserving the natural resources of the basin. For the economic impacts of climate change using Global Circulation Models, allocate-and-trade will recover nearly all of the efficient outcomes, measured in terms of basin-wide benefits.

Conclusion

Water trade can help riparian countries secure equivalent volumes of water, compared with status quo, with superior economic benefits. In other words, water trade could make better off both upstream countries as well as those downstream riparian countries that hold firm to maintaining the status-quo allocation. This could lead to an important step in Nile dialogue that has been stalled by the fear that any intervention could damage the economic benefit of the downstream riparian countries.

To take advantage of the water trade that addresses regional water allocation and helps internalizing externalities, establishing a basin institution is a prerequisite. A possible role for NBI could be to centralize planning and internalize externalities, to administer water rights arrangements, and to redistribute side payments from water rights arrangements. The other valuable insight is that the basin’s welfare could be increased through Nile River water demand management practices, such as decreasing evaporation loss, improving irrigation technology and increasing hydropower production efficiency. A basin-wide institution (such as the NBI) could also serve as a facilitator of exchange of information on water demand management practices among the riparian states.

Evaluating the potential Pareto improvement from these practices, welfare value of engaging in hydropower and agricultural output trade, and introducing interannual dynamics, damage functions and side payments that work between upstream and downstream riparian countries will be part of future research.

This policy note is based on a paper “Modeling efficiency, equity and externality in the Eastern Nile River Basin” (http://wspc.ucr.edu/working_papers/WSPC_WP_02_0611_Modeling_Nile.pdf)