IRRIGATION EFFICIENCY AND CONSUMPTION: THE REBOUND EFFECT IN WATER

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Abstract

Water is increasingly scarce from climate change, population growth and higher demand for food and irrigation. To ensure future food security and meet the increasing demand for water in populated regions, the agricultural sector has to improve irrigation efficiency with the aim to save water. However, these gains in the performance of irrigated agriculture will result in an effective reduction in the unit price of irrigation. Therefore, the consumption of irrigation water increases resulting in a rebound effect. This increased consumption partially offsets the expected water savings that may be achieved. Based on the new version of the GTAP-W model, we assess the extent of the rebound effect in water use and its economic implications when irrigation efficiency is improved worldwide to the maximum attainable level. The GTAP-W model distinguishes between rainfed and irrigated agriculture and includes irrigation water as an explicit factor of production for irrigated agriculture. The GTAP-W model accounts for water use in the agricultural sector, the largest user of freshwater resources. The results show that improving irrigation efficiency worldwide to the maximum attainable level causes a global total rebound effect of around 42 to 48 percent, depending on the scenario. The estimated irrigation rebound is larger relative to typical estimates of the rebound effect in energy demand. The total rebound effect for different regions varies widely depending on their current irrigation efficiency levels, structure of the agricultural sector and regional trade patterns. The total rebound effect is decomposed into three components: within own sector, within own economy and international trade. The results suggest a larger rebound effect in regions with relatively poor irrigation performance. These regions use more water because they experience positive impacts in food production and trade since their relative competitive position improves compared to other regions.

Keywords: Computable General Equilibrium, Water Policy, Water Scarcity, Irrigation, Rebound Effect

JEL Classification: D58, Q17, Q25

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