

Socioeconomic dynamics of water quality in the Egyptian Nile

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Abstract

The Nile River remains the most important source of freshwater for Egypt as it accounts for nearly all of the country's drinking and irrigation water. About 95% of the total population is accounted to live along the Banks of the Nile(1). Therefore, water quality deterioration in addition to general natural scarcity of water in the region(2) is the main driver for carrying out this study. What further aggravates this issue is the water conflict in the Blue Nile region. The study evaluates different water quality parameters and their concentrations in the Egyptian Nile; further assessing the temporal dynamics of water quality in the area with (a) the Environmental Kuznets Curve (EKC)(3) and (b) the Jevons Paradox (JP)(4) in order to identify water quality improvements or degradations using selected socioeconomic variables(5). For this purpose various environmental indicators including BOD, COD, DO, Phosphorus and TDS were plotted against different economic variables including Population, Gross Domestic Product (GDP), Annual Fresh Water Withdrawal and Improved Water Source. Mathematically, this was expressed by 2nd and 3rd degree polynomial regressions generating the EKC and JP respectively. The basic goal of the regression analysis is to model and highlight the dynamic trend of water quality indicators in relation to their established permissible limits, which will allow the identification of optimal future water quality policies. The results clearly indicate that the dependency of water quality indicators on socioeconomic variables differs for every indicator; while COD was above the permissible limits in all the cases despite of its decreasing trend in each case, BOD and phosphate signified increasing concentrations for the future, if they continue to follow the present trend. This could be an indication of rebound effect explained by the Jevons Paradox i.e. water quality deterioration after its improvement, either due to increase of population or intensification of economic activities related to these indicators.

Keywords: Water quality dynamics, Environmental Kuznets Curve (EKC), Jevons Paradox (JP), economic variables, polynomial regressions, environmental indicators, permissible limit

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