Abstract: Drought Response and Irrigation: Overcoming Lacunae in Impact Assessment and Decision Making

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Southern Europe is becoming drier. Adverse climatic conditions may reduce rainfed agricultural production and farmers are likely to adapt by increasing their irrigation demand. With high confidence, water demand for crop irrigation is expected to increase by more than 40% up to 2080, further strengthening the irrigation expansion trend of the last 50 years (IPCC, 2014). Declining runoff and groundwater resources in Mediterranean catchments will fall increasingly often short of expanding irrigation demand, giving rise to more frequent and intense drought events (EC, 2012). Higher environmental standards and inelastic supply suggest that future drought response will demand more frequent and intense restrictions in irrigation withdrawals (OECD, 2014). In this context, there is a pressing need to better understand the economic impacts of irrigation restrictions, including their microeconomic and economy-wide repercussions. Consistent and relevant information is instrumental for cost-effective drought management. Integrated Modelling Frameworks (IMF) at different geographical scales play a key role in this respect, providing the data to inform decision making in DSCs and C&C contexts alike. IMF typically optimize an objective function subject to a series of physical and management constraints following agronomic, hydrological, hydro-economic or economic criteria (Singh, 2012). The analysis conducted in this paper falls in the latter category.

This paper presents a methodological framework that nests a bottom-up microeconomic RPM into a top-down macroeconomic IO model. RPM and IO models present a series of advantages over alternative approaches, and can be coupled with relatively low computational requirements (see Section 3). The goal is to assess the economic impacts of seasonal irrigation restrictions, including their microeconomic and economy-wide repercussions. The methodology is resolved in two stages: in the first stage, a microeconomic RPM estimates the impacts of alternative irrigation restrictions on the income of agents; in the second stage, estimated impacts are imported into a macroeconomic input-output model (MRIA model) to assess economy-wide losses across sectors and regions within the economy. To the best of our knowledge, this is the first time both models are integrated.

Methods are illustrated with an application in the Lower Po River Basin (LPRB) in Northeastern Italy. Despite its growing drought exposure and inflating agricultural losses, decision-making in the LPRB is based on hydrological information only. By means of a thorough representation of agents' preferences and response and related economy-wide repercussions, this research can be used to estimate the abatement costs of overallocation and support decision-making processes based on advanced information management.

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