MODELLING A POST KEYNESIAN ENVIRONMENTAL MACROECONOMIC SYSTEM BASED ON KALECKIAN MICRO-INVESTMENT BEHAVIOUR: AN AGENT-BASED APPROACH WITH APPLICATION TO THE MURRAY-DARLING BASIN, AUSTRALIA

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An agent-based approach is used to conduct macroeconomic policy decision analysis of agricultural water sustainability in the Murray-Darling Basin (MDB), South Eastern Australia. The paper demonstrates the use of an agent-based model (ABM) as a simulation tool for improved decision-making by river basin regulators. Post Keynesian environmental macroeconomics (PKEM) is rooted in a dynamic theory of micro-investment behaviour by heterogeneous farming enterprises. The Kalekian tradition guides our structuring and integrating of the ecological-economic system dynamics (SD) of income distribution, fiscal policy decisions, unemployment, and uncertain global climate change. Although studies have begun to question the ecological sustainability and economic sustainability of managed agricultural ecosystems, they often use mainstream neoclassical economic growth theories based on the Cobb-Douglas production function, which over-emphasises aggregate substitution among capital inputs. In this article, we reconstruct the interactions between macroeconomic and macroecological dynamic systems using a multi-agent dynamic model of agricultural water management. Multiple agents (farmers and farm workers) harvest multiple crops, earn the wages and profits, and allocate the amounts of their income to consumption and saving. We introduce profitability gap functions governing the heterogeneous micro-investment behaviour of farmers engaged in markets characterised by fundamental uncertainty. We demonstrate a situation where both economic boom and bust lead to an increase of water consumption, as well as ecosystem unsustainability for most farmers. As an alternative, we introduce a fiscal approach in which government sets a sustainable water allocation target for the total harvest and redistributes the income and fiscal subsidies to the farmers with the intention of ameliorating the severity of business cycles. The simulation reveals an achievable growth perspective, leading to a sustainable development of ecosystem services and continuous improvements of well-being for all farmers and their workforces. It also introduces and demonstrates a novel approach for simulating the dynamic behaviour of heterogeneous farmers.