INFLUENCE OF ECONOMIC AND POPULATION GROWTH ON CARBON EMISSIONS THROUGH AN AGENT-BASED MODEL

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Abstract:

Increase of the atmospheric carbon dioxide concentration due to anthropogenic emissions generated by energy consumption of fossil fuels, is increasing the additional greenhouse effect. Population growth rates have declined over the last fifty years in almost every country in the world, showing a reduction in fertility rates and an increase in life expectancy at birth. The significant social and health care have decreased infant mortality and increasing longevity, producing a demographic transition and a change in the structure of the population, which manifests as a relative aging of the same. Currently, analysis of demographic transitions on economic growth has become relevant in the debate on climate change, given that the impact of these transitions has a direct impact on consumption of goods, primary energy and carbon emissions by changing the accumulation of greenhouse gases in the atmosphere.

To study the influence of population dynamics and economic growth on energy consumption and carbon emissions, we integrated economic variables such as consumption and investment rates, and growth variables such as birth and death rates, in an endogenous economic growth model with physical and human capital through an Agent-Based Model (ABM). The ABM is a simulation paradigm from which a system is modelled as a set of autonomous entities, called agents, able to act and make decisions based on a set of rules imposed by the modeller. Agents can evolve and adapt, and are able to execute several actions independently, at the same time interacting with other agents and their environment.

We obtained different scenarios: high, medium and low, for production, primary energy consumption, and carbon emissions, as well as, technology factors. The results are in good agreement with historical data and projections by various agencies. The model predicts long-term stagnation of the economy as a result of the reduction in the population growth rate. This fact will result in a stabilization and/or reduced energy consumption and carbon emissions, provided that the values of energy and emissions intensity continue to maintain a downward trend.

Since of the model developed can be inferred what kind of development is expected or desirable, and what factors are driving or slowing down a given path, this being a useful tool to take mitigation measures and / or adaptation.

The use of MBA allowed us an easy inclusion of the concept of choice´s behaviour and decision making of individuals, which otherwise would result in a large computational cost.