Modelling Social Influence and Cultural Variation in Global Low-Carbon Vehicle Transitions

Authors : Hazel Pettifor, Charlie Wilson, David Mccollum, Oreane Edelenbosch

Abstract : Vehicle purchase is a technology adoption decision that will strongly influence future energy and emission outcomes. Global integrated assessment models (IAMs) provide valuable insights into the medium and long terms effects of socio-economic development, technological change and climate policy. In this paper we present a unique and transparent approach for improving the behavioural representation of these models by incorporating social influence effects to more accurately represent consumer choice. This work draws together strong conceptual thinking and robust empirical evidence to introduce heterogeneous and interconnected consumers who vary in their aversion to new technologies. Focussing on vehicle choice, we conduct novel empirical research to parameterise consumer risk aversion and how this is shaped by social and cultural influences. We find robust evidence for social influence effects, and variation between countries as a function of cultural differences. We then formulate an approach to modelling social influence which is implementable in both simulation and optimisation-type models. We use two global integrated assessment models (IMAGE and MESSAGE) to analyse four scenarios that introduce social influence and cultural differences between regions. These scenarios allow us to explore the interactions between consumer preferences and social influence. We find that incorporating social influence effects into global models accelerates the early deployment of electric vehicles and stimulates more widespread deployment across adopter groups. Incorporating cultural variation leads to significant differences in deployment between culturally divergent regions such as the USA and China. Our analysis significantly extends the ability of global integrated assessment models to provide policy-relevant analysis grounded in real-world processes.

Keywords : behavioural realism, electric vehicles, social influence, vehicle choice