Which levers matter for the value of climate action?

Topic: Input-Output Modelling: Energy policies (4)
Author: Lucia SEQUEIRA
Co-Authors: Frederic Reynes

Achieving carbon neutrality requires large and sustained reductions in greenhouse gas emissions while maintaining economic stability and social acceptability. In this context, the Value of Climate Action (VAC) plays a central role in guiding public policy and investment decisions. The VAC corresponds to the carbon value obtained under a cost-effectiveness approach, which consists in minimizing the total cost of achieving a given emissions target. In the international literature, the closely related concept of the Social Cost of Carbon (SCC) is often used instead. Unlike the VAC, however, the SCC is generally derived from a cost-benefit approach that attempts to estimate the marginal damage of emissions and implicitly assumes the existence of an â€œoptimalâ€• level of emissions and warming. This paper discusses these different approaches and investigates how modelling assumptions regarding technological change, behavioural adjustments, and the broader macroeconomic environment affect the trajectory of the VAC, using a Computable General Equilibrium (CGE) model.

Our analysis relies on the French version of ThreeME, a hybrid macroeconomic model designed to evaluate the economic impacts of environmental policies. For the purpose of this study, we use a reduced version of the model with eight sectors, distinguishing between carbon-intensive and low-carbon activities in energy and transport, alongside services, industry, vehicles and construction. This sectoral structure allows us to capture key substitution mechanisms between fossil and low-carbon technologies while preserving macroeconomic consistency across production, consumption and trade.

The modelling exercise focuses on energy-related emissions, which represent approximately 63% of total national greenhouse gas emissions in France. The emissions trajectory used as a constraint in the simulations is derived from the French National Low-Carbon Strategy (SNBC) and applied to the energy perimeter of the model. The VAC is then computed as the carbon price required for the economy to follow this emissions pathway. The model therefore generates endogenous carbon price trajectories consistent with the targeted emissions reductions.

The analysis is structured around five cumulative scenarios, constructed through the sequential introduction of additional policy or structural assumptions. The baseline scenario represents a situation in which energy demand evolves proportionally with income, without behavioural moderation, changes in carbon sinks, or structural shifts in energy prices and technologies. The second scenario introduces behavioural sufficiency, reflecting changes in mobility and housing practices that reduce energy demand. The third scenario adds an expansion of carbon sinks, representing enhanced natural or technological absorption capacities. The fourth scenario incorporates a trend increase in fossil energy prices, capturing the potential effects of global market developments or climate-related taxation. Finally, the fifth scenario allows for increasing technological substitution possibilities between energy sources over time, reflecting the diffusion of low-carbon technologies and improvements in system flexibility.

The results highlight several key findings. First, the VAC trajectories are strongly convex, indicating that marginal abatement costs increase rapidly as emissions reductions approach the most difficult-to-abate sectors. Second, behavioural changes and technological progress significantly reduce the required carbon value, particularly in the long term. Third, carbon sinks and energy price dynamics provide additional but more moderate reductions, with their effects becoming more pronounced toward the end of the transition period. When all levers are combined, the VAC required to reach the emissions target is reduced by nearly 70% compared with the baseline scenario by 2050.

These findings contribute to the literature on climate policy modelling by illustrating how the

interaction between demand-side behaviour, technological change and macroeconomic conditions shapes the economic cost of decarbonization. The results suggest that relying solely on carbon pricing may lead to very high required carbon values if complementary policies are absent. Instead, an effective transition strategy likely requires a combination of behavioural policies, innovation support, energy market transformations and carbon sink development.
By highlighting the sensitivity of the VAC to structural assumptions, this study provides useful insights for policymakers designing credible and socially acceptable decarbonization pathways within a macroeconomic modelling framework.