The Service Science of Climate Change Policy Analysis: applying the Spatial Climate Economic Policy Tool for Regional Equilibria

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The use of Computable General Equilibrium modelling in evidence-based policy requires an advanced policy making frame of reference, advanced understanding of neoclassical economics and advanced operations research capabilities. This paper examines developments in neoclassical economic models for the analysis of strategy and policy. Regions and industries have the ever-present challenge of building a future where production is competitive and employment is durable. In this context, the inhibitor effects of potential climate constraints on regional industries and bilateral trade is currently a topic of major concern to polity. Threats often bring opportunities and these are sometimes major disruptions to traditional industry structure. Therefore of equal interest to some policy makers are the strategic opportunities that a window of superior domestic productivity and resource expansiveness may bring to nations seeking a transformative boost in export performance. The Spatial Climate Economic Policy Tool for Regional Equilibria (Sceptre) is an intertemporal, multiregional general equilibrium model for investigating regional and industry strategies in the presence of global policies such as carbon emission constraints. In its simplest mode, Sceptre translates global climate policies to regional and commodity effects. This is achieved by bringing together traditional markets for commodities with new markets in carbon commodities. These new markets are emission permits trading and a technology function for carbon abatement and amelioration. A general equilibrium is settled by optimising a social welfare function, in the mode of a Negishi format, within a nonlinear economic-climate feedback loop. Both the technology function for carbon abatement and amelioration and the economic-climate feedback loop have precedent in William Nordhaus' DICE model. The social welfare function comprises regional economic expansion factors, which are developed in a multiregional context using a data envelopment or benchmarking technique successfully applied by Thjis ten Raa to single period national and bilateral models. In a novel intertemporal innovation, Sceptre draws together disciplines of economics and finance by substituting resource constraints with Dupont sales to asset ratios in order to dynamically link and mediate the stocks and flows of each commodity. This avoids the issue in Ramsey models that investment is merely an uncontrolled residual of production and consumption, and the issue in the Leontief B-matrix approach that final industry assets are cannibalised. Regionally aggregated Make and Use matrices drawn from GTAP's Social Accounting Matrices are used in the underling economic model as regional-commodity production function tableaux. Outputs for policy consideration include global geophysical climate effects, regional and industry activity levels, bilateral trade flows, potential resource expansiveness, investment, labour and regional and industry rate of transition from carbon trading to carbon amelioration and abatement.