Modelling transport modal shift in TIMES models through elasticities of substitution

Several efforts have been directed lately towards the endogenisation of transport modes competition in Energy/Economy/Environment/Engineering (E4) models. TIMES-DKEMS is a novel methodology paving the way for applying elasticities of substitution to incorporate transport modal shift into TIMES (The Integrated MARKAL-EFOM System) models. Substitution elasticities are defined for four transport demand aggregates, each corresponding to a different distance range class. Within an aggregate, modal demands can adjust their levels according to the defined substitution elasticity and in response to changes of their shadow prices relative to a reference case. The total volume of the transport demand over the aggregate is conserved and modal shift potentials are implemented to guarantee realistic dynamics. The behavior of TIMES-DKEMS is tested under an arbitrary environmental policy, an increasingly stringent bound on CO2 emissions. Modal shares are compared with the standard version of TIMES-DK. Results show that in 2050, 11% of car mobility demand is substituted by more efficient and less costly modes such as train and coach. A sensitivity analysis on the values of substitution elasticities indicates that higher absolute values correspond to larger modal shift. Finally, other model constraints, such as mode-specific travel patterns, interact with the substitution mechanism resulting in a modal shift containment.