Energy-Economy Model Calibration

Overview

- Production Function Parameters
- Applied Model Calibration

Production Function Parameters

$$Y = \left\{ \alpha \left[(K^{sk} L^{sl})^{\rho} + \beta (E^{se} P^{sp} S^{ss})^{\rho} \right] \right\}^{1/\rho}$$

α, β: *distribution parameters* >0

- ✓ The partial derivative of this function with respect to capital represents the marginal productivity of capital
- ✓ Define the labor force index in the base year as L=1 and substitute all other base year values → α
- ✓ Substitute all factor and gross production values into the production function → β

Production Function Parameters

$$Y = \left\{ \alpha [(KD^{skd}\, KF^{skf})^{sk} L^{sl}]^{\rho} + \beta\, INT^{\rho} + (1-\alpha-\beta)[E^{se}\, P^{sp} S^{ss}]^{\rho} \right\}^{1/\rho}$$

α, β: *distribution parameters* >0

- ✓ The partial derivative of this function with respect to KD represents the marginal productivity of capital
- ✓ Define the labor force index in the base year as L=1 and substitute all other base year values → α
- ✓ The partial derivative of this function with respect to P represents the price of oil
- ✓ Substitute all other base year values → β

Production Function Parameters

$$Y = A\left[\alpha(K^{KPVS}L^{1-KPVS})^{\frac{\sigma-1}{\sigma}} + (1-\alpha)E^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}$$

Nonlinear least squares (NLS) regression. The non-linear solution to the estimation problem of the parameters, will come through the minimization of the following sum of squares, $S\ A,\alpha,\sigma$

$$S(A,\alpha,\sigma) = \frac{1}{2}\sum_{t=1988}^{2014} e_t^2$$

$$S(A,\alpha,\sigma) = \frac{1}{2}\sum_{t=1988}^{2014}\left[Y_t - A\left[\alpha(K_t^{KPVS}L_t^{1-KPVS})^{\frac{\sigma-1}{\sigma}} + (1-\alpha)E_t^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}}\right]$$

Application on Turkish data: Küçük, M, Kumbaroğlu, G., Sarıca, K. (2018). Substitution elasticities in an energy-augmented CES production function: An empirical analysis for Turkey, *Journal of Economics and Political Economy*, Vol.5(2), pp.234-249.

Production Function Parameters

Temple, J. (2012). The calibration of CES production functions, Journal of Macroeconomics, Vol.34(2).

Applied Aggregate Economic Equilibrium Modeling