Inferring Frisch Parameters from Demand Elasticities: Constructing a Database of Frisch Parameters Using Generalised Cross-Entropy Estimation

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The Linear Expenditure System (LES) remains an important demand system specification in applied economic modelling and certainly dominates the specifications found in single country computable general equilibrium (CGE) models to date, despite its simplicity and known limitations. Its strength lies precisely in this simplicity. Its calibration is easy and only requires a set of income elasticities of demand and a Frisch parameter. Moreover, it maintains theoretical consistency (regularity) over wide ranges of price and income values. It also poses no problems for numerical solvers.

Nevertheless, while a constantly growing body of empirical literature econometrically estimates price and income elasticies of consumption demand with a variety of demand system specifications using microeconomic data, few such studies estimate the Frisch parameter – the elasticity of the marginal utility of expenditure with respect to total expenditure.

To address this gap, we propose an alternative approach. The LES is typically calibrated using income elasticities for n consumption items plus a Frisch parameter. However, due to the adding-up constraint of demand systems, only $n-1$ income elasticities are independent, yielding n independent parameters in total. Price elasticities are implicitly determined once these parameters are specified. Our approach exploits substantially more information: we use complete sets of empirically estimated price and income elasticities to parameterise an Extended LES (ELES) and back out the Frisch parameter most consistent with these elasticities.

This is accomplished using an information theoretic method, namely a generalised cross entropy (GCE) estimation procedure that finds ELES parameters minimising the distance between implied and target elasticities while enforcing all integrability restrictions (adding-up, homogeneity, symmetry, and curvature) as required by demand theory.

The input elasticity sets are extracted from the literature on microeconomic demand system estimation, which typically uses household survey data from various countries and years and different demand system specifications.

The study has two goals:

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1. To consistently estimate Frisch parameters for multiple countries and years based on empirically estimated demand elasticities and construct a corresponding database for applied demand modelling.
2. To analyse the estimated Frisch parameters for patterns emerging, particularly across time, space, and income levels.

The resulting Frisch parameters will be contrasted with existing estimates from the literature.

State of the Research

The GCE estimation procedure has been implemented in GAMS and thoroughly tested. The extraction of elasticity data from the literature estimating demand systems is in an advanced stage. The tasks remaining for the coming three months are: completion of the demand elasticities input database, application of the GCE procedure to estimate the Frisch parameters, analysis of the results, and write up of the paper.