Will Income or Population be the Main Driver of Food Demand Growth to 2050?

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**OBJECTIVES**

We test whether income or population will be the main driver of global food demand to 2050.

- A key element in this study is to understand how the income elasticities of demand for food will evolve as incomes rise.
- For this purpose, we develop a long-run, non-homothetic, partial equilibrium SIMPLE-MAIDADS Model.
- We use this framework to determine the relative importance of income and population growth in driving global food output to 2050.

**WHAT IS THE KEY DRIVER?**

Baldos and Hertel (2014) → Income
- Population grows more in poorer countries where consumption is low.
- Strong income-driven demand for dietary upgrading in rich countries.

Gouel and Guimbard (2018) → Population
- Population persists as the main driver of global food demand to 2050.
- Their analysis abstracts from the supply side of the puzzle.

We seek to resolve this puzzle by incorporating a new demand system (MAIDADS) into the SIMPLE model of global food supply and demand.

**INCOME AND POPULATION GROWTH: 2010-2050 (AUTHORS’ CALCULATIONS, SSP2)**

**RESULTS (DEMAND SIDE)**

- As income rises from 2010 to 2050, the impact of income is negative on global crop consumption, contrary to standard SIMPLE Model.
- On the other hand, the impact of population is positive on global crop consumption.
- In addition, the impacts of the two drivers are positive on all other food demand categories.
- We also look at the numerical decomposition at regional level, the significance and direction of the demand drivers vary across regions.

**CONCLUDING REMARKS**

- We are still working on the new production structure to look more closely at the demand drivers, as the central finding will eventually depend on the supply side results.
- Currently, the prices in these simulations are constant. When price is fixed, the impacts of drivers on future food consumptions strictly vary by geographic regions and across demand categories.
- Our next step is to understand the endogenous price mechanism on the flexible demand system, which will hopefully help us better understand the issue of resource uses in the future.

**REFERENCES**


**DEMAND MODEL**

The origin of MAIDADS dates back to Richard Stone (1954)'s Linear Expenditure System (LES):
1. Derived from Roy Geary (1936).
2. An origin displaced Cobb-Douglas utility.
3. Fixed discretionary consumption.
4. Fixed subsistence consumption: whereas MAIDADS (Modified An Implicitly Directly Additive Demand System)
   - Generalised from Rimmer and Powell (1996).
   - Discretionary demand varies with expenditure.
   - Subsistence demand varies with utility level.

Mathematical Section

The MAIDADS is developed by Preckel, Cranfield and Hertel (2010): x_{i,g} = \alpha_i + \beta_i\omega_{i,g} + \sum_{j=1}^{N} \delta_{i,j}\gamma_{j}(1 + \beta_i g_j)\omega_{i,g}

\begin{align*}
\text{Discretionary Consumption} & = \alpha_i + \beta_i\omega_{i,g} \\
\text{Subsistence Consumption} & = x_{i,g} - \beta_i g_j\text{Marginal Budget Share}
\end{align*}

Data and Methods

- We build the MAIDADS demand system into the TABELO program of GEMPACK based on the standard SIMPLE Model across modified 15 geographic regions and 5 demand categories.
- The MAIDADS parameters are estimated using constrained maximum likelihood following Gouel and Guimbard (2018).
- We then design a new structure of the CES production (see below).
- Furthermore, we use the latest update of the macroeconomic data for the transformed “middle of the road” Shared Socioeconomic Pathways (SSP2) version 9 scenarios from 2010 to 2050.
- Finally, we address our question using the numerical decomposition technique of Harrison, Horridge and Pearson (2009) to identify the relative contribution of different drivers of endogenous drivers.