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Estimation of food demand elasticities across countries: An EASI application

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Introduction

Examination of global food demand over time is necessary for projecting global food demand and supporting policies designed to improve global food security.

The objective of this study is to

1. inform about how price and income affect food demand
2. estimate elasticities by country and by food using historical data
3. produce theoretically consistent demands for applied analysis

Data and Methodology

- Aglink-Cosimo model data generated by OECD - FAO
- Grains, proteins foods, sugar, fruits and vegetables, dairy, fats and oils, and others
- 47 countries and regions
- Use Fisher Ideal price index for each item
- The **Exact Affine Stone Index** (EASI) demand system model:

$$w_{ict} = \sum_{j=1}^J \{ \alpha_{ij} \log(p_{jct}) + \alpha_{ijc} z_c \log(p_{jct}) \} \\ + \sum_{r=1}^L b_{ir} y_{ct}^r + \sum_{c=1}^{C-1} h_{ic} z_c y_{ct} + \sum_{c=1}^{C-1} g_{ic} z_c + \tau_i T_t + u_{ict},$$

$\forall i = 1, \dots, 7; c = 1, \dots, 11; r = 1, \dots, L; t = 2002, \dots, 2021,$

where

w_{ict} : the budget share of commodity i in country group c in year t ;

p_{jct} and p_{ict} : the price of commodity j and i in country group c in year t ;

y_{ct} : the Stone price-deflated real GDP;

L : the highest-order of polynomial in real income ($L=4$);

z_c : a dummy variable for region c (see map);

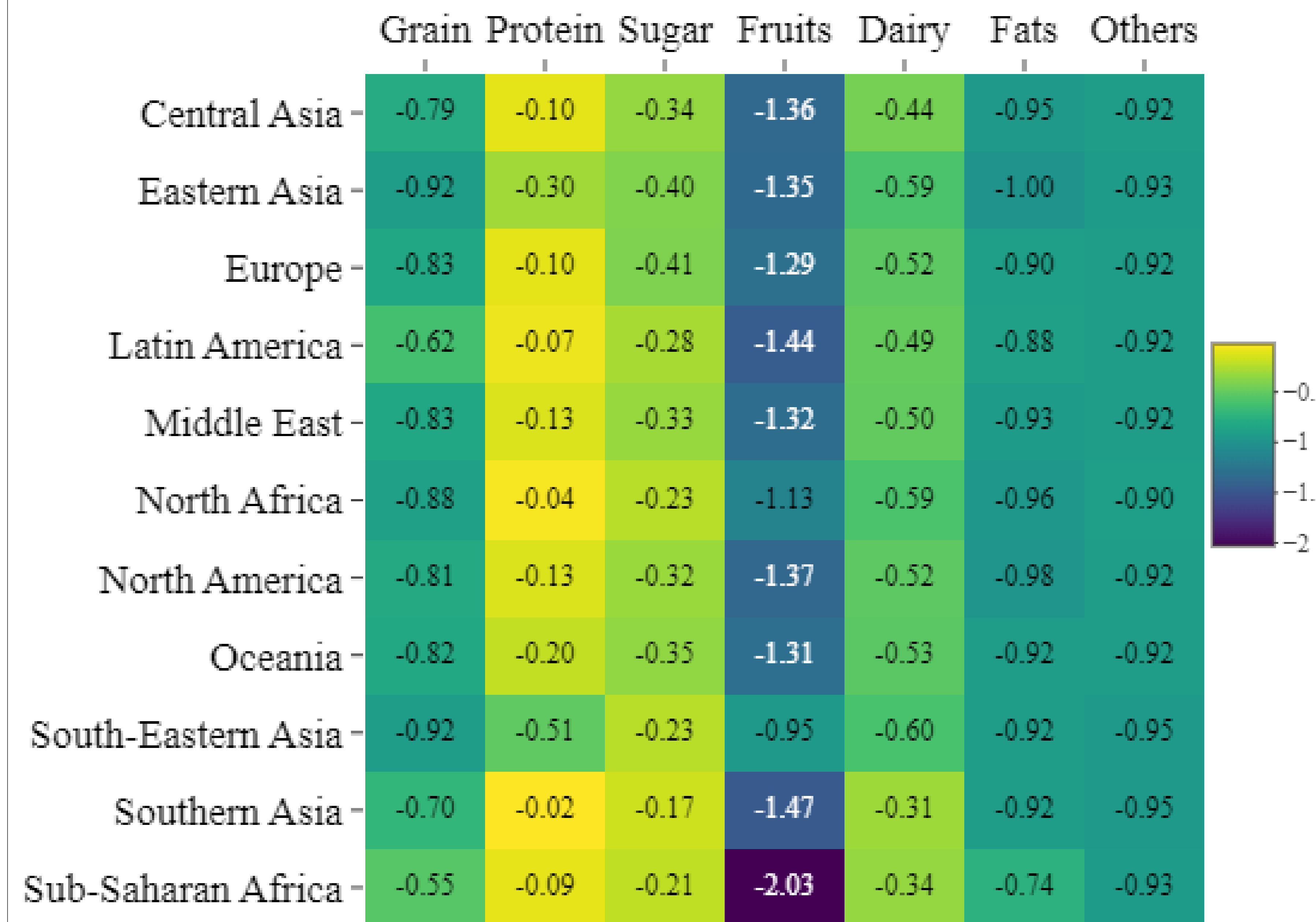
T_t : a time variable equal to the calendar year minus 2010;

u_{ict} : unobserved budget share determinants;

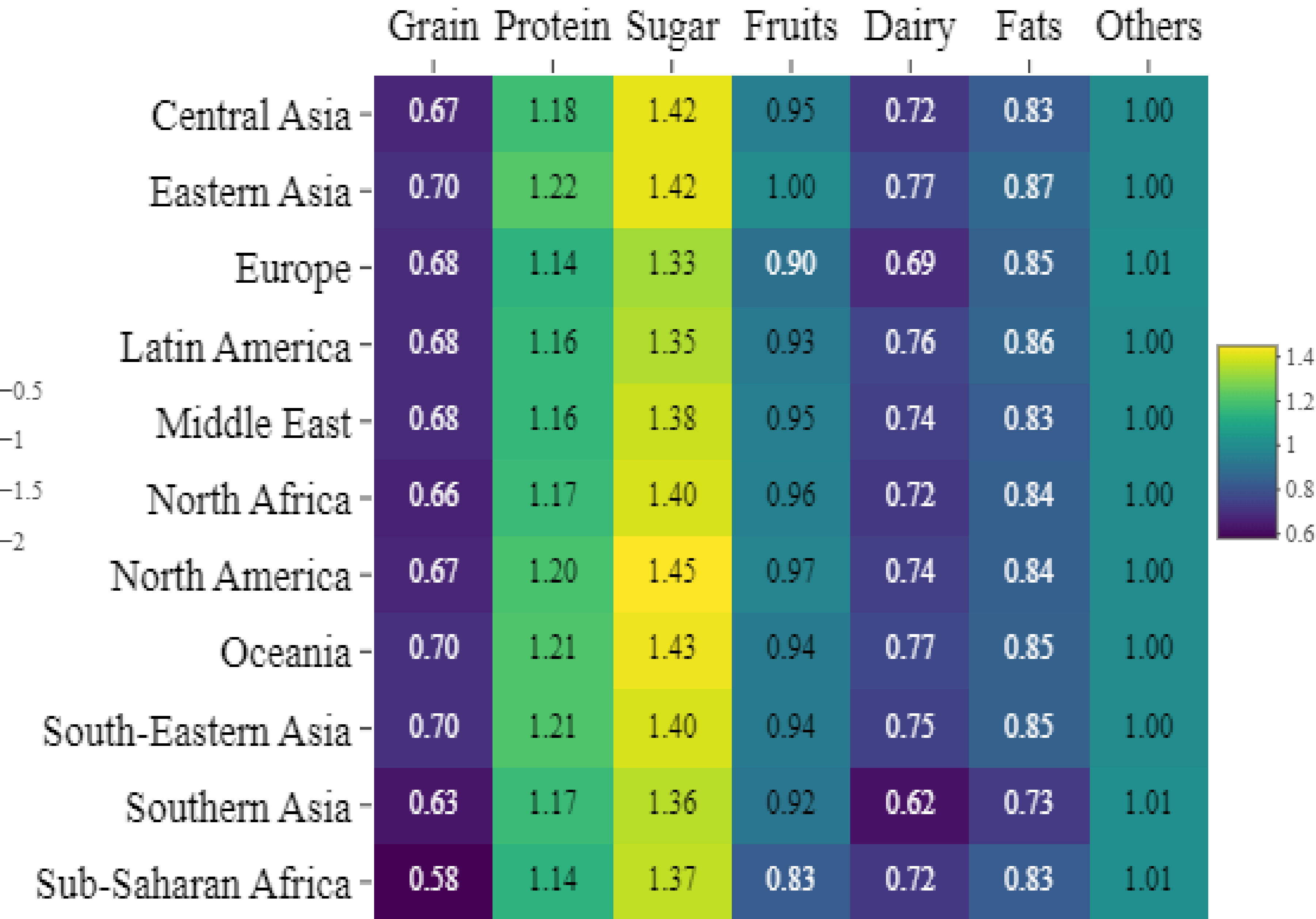
α_{ij} , α_{ijc} , b_{ir} , g_{ic} , and τ_i : estimated parameters.

- Impose demand constraints (homogeneity, adding-up, and symmetry)
- Estimate using iterated linear three-stage least squares (3SLS)

Marshallian Own-price Elasticities

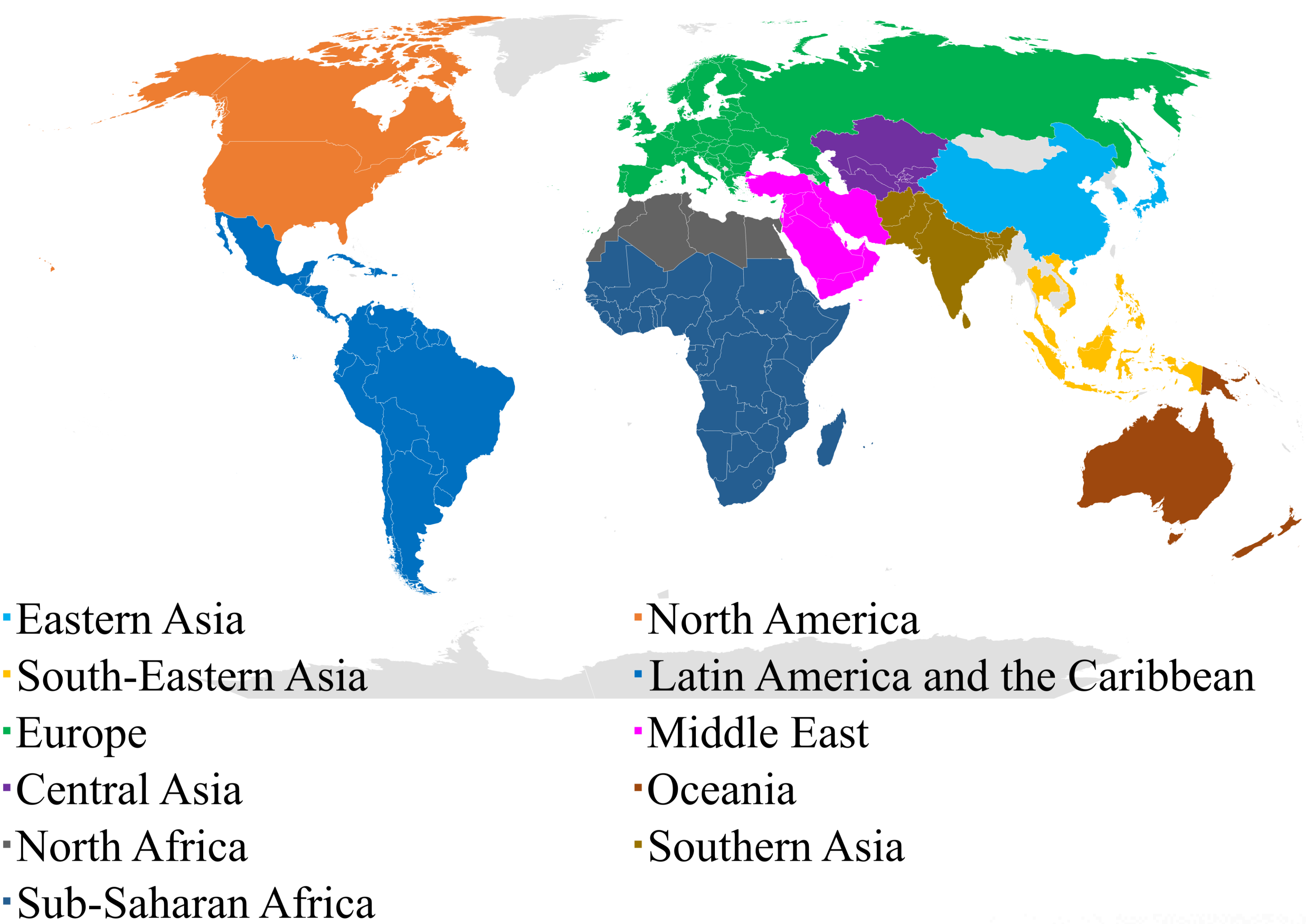


Income Elasticities



Note: Fruits = Fruits and vegetables; Fats = Fats and oils

Regional Groups



Conclusions

Estimate 77 own-price elasticities, 462 cross-price elasticities, and 77 income elasticities

- *Own-price elasticities*
 - Fruits and vegetables demand most elastic; protein demand least elastic
 - Sub-Saharan Africa more elastic for fruits and vegetables
 - South-Eastern Asia more elastic for protein
- *Income elasticities*
 - Sugar most sensitive to income changes; grains least sensitive to income changes
 - Income effects largest for protein, fruits and vegetables, and fats and oils in East Asia
 - Income effects smallest for dairy and fats and oils in Southern Asia

Future research

- Considering price endogeneity and estimating country-level demand elasticities

Relevant publications

- Lewbel, A., and K. Pendakur. 2009. "Tricks with Hicks: The EASI Demand System." *American Economic Review* 99(3):827-63.
- OECD-FAO. Aglink-Cosimo data. Available at <https://www.agri-outlook.org/data>.

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