

# Consumption Patterns among OECD Countries: Demand System Estimation for Panel Data with Random Effects

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## Introduction

- This paper analyzes food consumption patterns across time for countries with different income levels.
- Utilizing multi-stage budgeting, the demand for nine broad categories of goods in the first-stage budgeting and eight detailed sub-categories of food in the second-stage budgeting are analyzed.
- We address the methodological issue of estimating a system of demand equations with panel-time series data with random effects.

### Multi-Stage Budgeting

#### 1<sup>st</sup> Stage Budgeting

Analysis of broad categories of goods

#### 2<sup>nd</sup> Stage Budgeting

Analysis of food sub-categories

#### Categories:

Food, beverage, and tobacco; clothing and footwear; education; gross rent, fuel and power; house furnishing and operations; medical care; recreation; transport and communication; and other expenditures

#### Categories:

bread and cereals; meat and fish; dairy; oils and fats; fruit and vegetables; other food; beverages and tobacco; food away from home.

## Model

- We develop and use the CBS-Florida model, where the price components, real expenditure, and Divisia volume index are deflated by their geometric means.
- The CBS-Florida model is similar to the Working-Florida model, which is an extension of the original Working's (1943) demand model endowing it with price relationships.

#### CBS-Florida Model:

$$W_i dq_i = \theta_i dQ + \sum_{j=1}^M \pi_{ij} d p_j + u_i$$

where:  $dp_i = \log \frac{p_i}{\bar{p}_i}$        $dq_i = \log \frac{q_i}{\bar{q}_i}$   
 $dQ_i = \log \frac{Q_i}{\bar{Q}_i}$        $\theta_i = \beta_i + w_i$

#### CBS Preference Independence (PI)-Florida Model:

$$W_i dq_i = \theta_i dQ + \varphi \sum_{j=1}^M (\theta_i - \theta_j) dp_j + u_i$$

where  $dQ = \sum_{i=1}^M (w_i dq_i)$  deflated by its geometric mean,  $w_i$  is budget share of good  $i$ ,  $dp_i = \log \frac{p_i}{\bar{p}_i}$ ,  $dq_i = \log \frac{q_i}{\bar{q}_i}$  and  $\bar{p}_i$ ,  $\bar{q}_i$ ,  $\bar{Q}_i$  are corresponding geometric means.

- CBS PI-Florida model is used in the first stage budgeting and CBS-Florida model is used in the second stage budgeting.

## Data

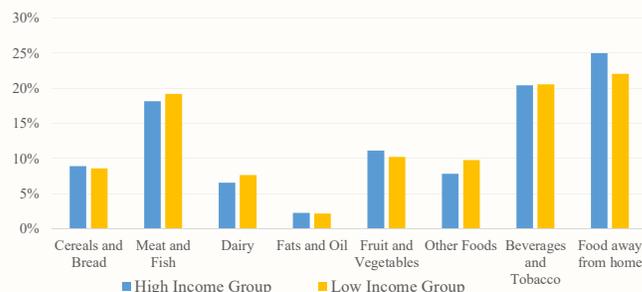
The data consist of panel time-series with five phases (1985,1990,1993,1996, and 1999) on consumption expenditures and prices in OECD countries. Consumption expenditures and prices expressed in different currencies are converted to comparable values relative to a base country using the Geary-Khamis (GK) procedure.

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## Findings

### Average Budget Shares for Food Sub-categories



### Income Elasticities of Demand

Model	Maximum Likelihood	Error Component Model
Cereals and Bread	0.469	1.102
Meat and Fish	0.582	1.163
Dairy	0.587	1.097
Fats and Oil	0.398	1.125
Fruit and Vegetables	0.681	1.183
Other Foods	0.468	1.122
Beverages and Tobacco	1.150	1.446
Food away from Home	1.831	1.481

### Slutsky Own-price Elasticities

Model	Maximum Likelihood	Error Component Model
Cereals and Bread	-0.061	-0.356
Meat and Fish	-0.349	-0.741
Dairy	-1.424	-0.834
Fats and Oil	-0.235	-0.450
Fruit and Vegetables	-1.125	-1.042
Other Foods	-1.339	-1.101
Beverages and Tobacco	-0.317	-0.592
Food away from Home	-0.841	-0.664

## Discussion

- The pooled estimates for the demand system were obtained by using two different methods of estimation: error component model and the method of maximum likelihood.
- Slutsky own-price elasticities computed using the pooled estimates from the second stage budgeting are all negative as expected. Estimations results show that the demand for other foods and fruit and vegetables are own-price elastic. All other food groups are price inelastic.
- Expenditure elasticities for all sub-groups in error component model are greater than one. This result is unusual and needs further investigation.
- The estimation of the first-stage budgeting is non-trivial due to nonlinearities and ongoing.

## References

- Theil, H., C. F. Chung and J. L. Seale, Jr. 1989. Advances in Econometrics: International Evidence on Consumption Patterns. Greenwich, CT and London: JAI Press.
- Working, H. 1943. Statistical Laws of Family Expenditure. Journal of the American Statistical Association 38: 43-56.