Caloric Consumption Efficiency and Import Dependency: Evidence from Sri Lanka

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Introduction

- Caloric sources of Sri Lankans: domestic and imported
- Import dependency ratio (IDR) ‣ IDR
- Heterogeneity of IDR ‣ Heterogeneity across sectors and expenditure deciles
- Caloric consumption efficiency: What is efficiency? How can caloric consumption be inefficient ?
- We ask what is the direction and magnitude of caloric import dependency on caloric consumption efficiency [poor, food-poor, and urban]

Motivation

- Health shock $\Rightarrow$ deteriorated external sector
  - Government of Sri Lanka resorted to import controls
  - Domestic food production drive [pulses, condiments]
  - Increased domestic food prices [food inflation is rising]
- Why does caloric consumption efficiency matter ?
  - Inefficient households can squeeze budget
  - Imported calories [inefficiency increasing or decreasing? : homogeneous or heterogeneous effect?]

Objectives

- Overall objective
  - To estimate the caloric consumption efficiency and the effect of import dependency on inefficiency
- Specific objectives
  - Estimate the cost efficiency of caloric consumption [total and cereal and pulses]
  - Estimate the effect of import dependency ratio on inefficiency
  - Estimate the heterogeneous effect of import dependency ratio across poor, food-poor, and urban households

Theoretical Framework and Methods

Theoretical Framework

- Cost inefficiency from recreational utility of food consumption (Banerjee and Duflo, 2007; Hazarika and Paul, 2021)
- Utility function
  $U(C, R) = U[C(F_1, F_2), R(F_1, F_2)]$
- Optimization:

$$\max \quad U(C, R) = U[C(F_1, F_2), R(F_1, F_2)] \tag{1}$$
$$\text{s.t.} \quad I = P_1F_1 + P_2F_2$$

- Necessary conditions for cost minimization
  - without recreational component: $C_1/C_2 = P_1/P_2$
  - with recreational component:
    $[C_1 + (U_2/U_1)R_1]/[C_2 + (U_2/U_1)R_2] = P_1/P_2$

- Necessary condition for cost minimization (with R)

$$([C_1 + (U_2/U_1)R_1]/[C_2 + (U_2/U_1)R_2] = P_1/P_2 \tag{2}$$

- Equation 2 approaches the necessary condition of cost minimization when there is only caloric utility of the food, $C_1/C_2 = P_1/P_2$, when
  - R_1 and R_2 decrease
  - U_2 decreases
  - U_1 increases

Theoretical Framework

- Theoretical predictions:
  - Factors that reduce the marginal productivity of food in production of recreation R_1 and R_2 increase the cost efficiency of caloric consumption
  - factors that decrease the marginal utility of recreation U_2 increase the cost efficiency.
  - factors that increase marginal utility of caloric consumption U_1, increase the cost efficiency
- Effect of import dependency ratio on cost efficiency: an empirical question

Methods

- Cost frontier

  $$lnC_i = lnC^*(w_{ji}, y_i) + \eta_i \quad (3)$$

  C_i is the household expenditure on metabolizable calories given by y_i

  w_{ji} is the price of food item j faced by the households

  $C^*(.)$ is the frontier cost function which gives the minimum cost given the vector of input price w_j faced by a household and observed level of output

- Cost is increased by η because of the input overuse
- By definition $\eta > 0$ and $\eta_i = lnC_i - lnC^*(w_{ji}, y_i)$ (Kumbhakar et al., 2015)

Methods

- Distributional assumptions
  - half-normal distribution: $\eta_i \sim N^+(0, \sigma_u^2)$ and $v_i \sim N(0, \sigma_u^2)$
  - truncated-normal $\eta_i \sim N^+(\mu, \sigma_u^2)$ and $v_i \sim N(0, \sigma_u^2)$
- Parameters estimated MLE
- LR test to choose the best model specification
- Included variables
  - female headed household, strenuous occupation, sector, ownership of a fridge, natural calamity, agricultural land ownership, poverty status
  - education and age of household head and monthly household expenditure
  - district fixed effects

Data Source

- Household Income and Expenditure Survey of Sri Lanka (2016)
- A nationally representative, stratified, randomly selected household survey
- Total number of households used for the analysis= 20, 839
- Unit of analysis is at the household-level

Key Variables

- **Household calories consumption:** calculated by using standard calorie conversion factors for each food item
- **Expenditure on calories consumed:** household expenditure on food
- **Stone price indices:** calculated for different food groups such as for cereals, vegetables, and meat. Zero stone price indices were replaced with community-wide geometric mean
- **Import dependency of calories** are calculated using the Import Dependency Ratios for food items

Key Variables cont.

- **Poor households** are defined based on the Sri Lanka's official poverty line, i.e. households whose monthly per capita expenditure is below LKR 4,166 (apx. 21 US$) is considered to be poor.
- **Food-poor households** are identified by calculating the food poverty lines for each district using the Greer and Thorbecke (1986) food poverty measure.
- X_h: monthly food expenditure per AEU at HH ; C_h:monthly calorie consumption per AEU at HH ; Z: food poverty line ; RMA:Recommended Monthly Allowance (RMA) of calories

$$lnX_h = \alpha_1 + \alpha_2 C_h \tag{4}$$

$$Z = e^{\hat{\alpha_1} + \hat{\alpha_2} * RMA} \tag{5}$$

Table 1: Mean cost efficiency by selected groups

Catergory	Efficiency	Observations	Mean	Std.Dev	Min	Max
Poor	All food	652	98.016	1.992	82.317	99.939
	Cereals and pulses	714	87.722	10.505	26.234	99.992
Non-poor	All food	19764	88.057	8.310	23.277	99.688
	Cereals and pulses	20125	85.950	11.320	9.876	99.994
Food poor	All food	4388	92.693	5.625	23.277	99.939
	Cereals and pulses	5489	88.329	10.154	20.222	99.994
Food non- poor	All food	16028	87.192	8.605	28.543	99.879
	Cereals and pulses	15350	85.182	11.566	9.876	99.994
Urban	All food	3320	83.962	9.659	23.277	99.573
	Cereals and pulses	3250	77.315	13.566	9.876	99.968
Non-urban	All food	17096	89.232	7.811	29.911	99.939
	Cereals and pulses	17589	87.617	10.032	18.386	99.994
Total	All food	20416	88.375	8.369	23.277	99.939
	Cereals and pulses	20839	86.010	11.297	9.876	99.994

Source: Authors' calculations based on estimated cost efficiency scores.

Results

Table 2: Determinants of the mean of the cost inefficiency -all food calories

Variable	Model 1	Model 2	Model 3
Urban sector	0.004	0.281	0.210
	(0.095)	(0.251)	(0.164)
Estate sector	0.394	-0.579	0.446*
	(0.286)	(0.661)	(0.253)
Import dependency ratio	0.044***	0.025***	0.043***
	(0.002)	(0.010)	(0.003)
Poor	-2.487***		-1.338**
	(0.650)		(0.520)
Food poor		2.365***	
		(0.305)	
Poor × IDR	0.030**		
	(0.014)		
Food poor × IDR		-0.049***	
		(0.014)	
Urban × IDR			-0.008
			(0.005)
Distribution	Truncated-normal	Truncated-normal	Truncated-normal
LR test statistics	3089.707***	30581.364***	33009.807***
Log likelihood	1000.992	-235.886	978.335
Observations	20,416	20,416	20,416
Quarter FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Weighted	Yes	Yes	No

Standard errors are clustered by PSU units; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimations.

Results

Table 3: Determinants of the mean of the cost inefficiency -cereals & pulses

Variable	Model 1	Model 2	Model 3
Urban sector	0.404***	0.691**	0.749***
	(0.104)	(0.275)	(0.237)
Estate sector	-0.122	-11.326***	-0.072
	(0.228)	(0.911)	(0.227)
Poor	0.228		0.137
	(0.317)		(0.118)
Food poor		0.899**	
		(0.444)	
Import dependency ratio	0.056***	0.020	0.054***
	(0.004)	(0.015)	(0.005)
Poor × IDR	-0.006		
	0.009		
Food poor × IDR		-0.037*	
		(0.019)	
Urban × IDR			-0.012**
			(0.006)
Distribution	Truncated-normal	Truncated-normal	Truncated-normal
LR test statistics	5665.514***	73299.366***	5321.294***
Log likelihood	561.7	-1464.633	389.5896
Observations	20,839	20,839	20,839
Quarter FE	Yes	Yes	Yes
District FE	Yes	Yes	Yes
Weighted	Yes	Yes	No

Standard errors are clustered by PSU units; *** p<0.01, ** p<0.05, * p<0.1

Source: Authors' estimations.

Results

- Inefficiency of total caloric consumption and IDR: Mixed results
  - Poor $\times$ IDR positive impact
  - IDR may indicates a recreational consumption
  - However food-poor $\times$ IDR shows a negative impact
  - Urban $\times$ IDR effect is negative but trivial
- Inefficiency of cereal and pulses based caloric consumption and IDR
  - food-poor $\times$ IDR shows a negative impact
  - Urban $\times$ IDR effect is negative
  - Consumption of imported cereals and pulses may increase the utility of caloric consumption

Conclusion and Policy Implication

- Import dependency of food-poor and urban negatively correlate with caloric cost inefficiency
- Poor households are relatively cost efficient
- Policy implications
  - Poor households are cost efficient: less chance for further budget squeezing
  - Urban and food poor consume imported calories to be cost efficient
  - Producer focused import controls are disproportionately affecting urban and food poor

Thank you!

Import Dependency Ratio

- Import dependency ratio per food item:

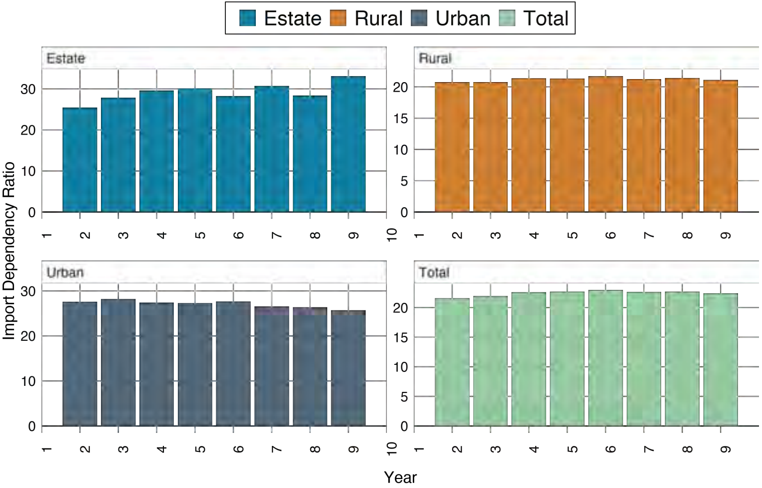
$$IDR = \frac{Imports}{Production + Imports - Exports} * 100.$$

- Household import dependency:

$$IDR = \frac{Imported\ Calories}{Total\ consumption\ of\ Calories} * 100.$$

◂ Introduction

Heterogeneity of IDR



Source: Author's illustration using HIES, 2016 and FAOSTAT data

FIGURE 1: IDR across sectors

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