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Impact of Some Government Policy Changes on the Demand for Selected Major Subsidiary Food Crops in Sri Lanka

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ABSTRACT: Since Sri Lanka is approaching self sufficiency in rice more attention should now be paid to the development of Subsidiary Food Crops (SFCs). The objective of this study is to develop an econometric model to explain the demand for cowpea, gingelly, greengram, and groundnut. Demand structure for SFCs would be useful as it would enable us to determine the effect of future changes in food policy on consumption patterns of SFCs and in the estimation of the food supply requirement of the country. The models were estimated using Zellner's Seemingly Unrelated Regression (SUR) method.

The results indicate that the demand for cowpea, groundnut and gingelly was relatively less responsive to income but highly responsive to own price. However, the demand for greengram is less responsive to own price but highly responsive to consumer income.

INTRODUCTION

Rice contributes to about 20 percent of the agricultural component of the Gross Domestic Product (Central Bank of Sri Lanka; 1989). It provides employment to over 40 percent of the workers engaged in agriculture. Rice supplies 72% of the daily calories and 60% of protein intake of an average Sri Lankan (Department of Census and Statistics; 1989). Due to its importance agricultural research has been dominated by rice in the past.

Because of the emphasis on rice production in the country the production and the institutional support for Subsidiary Food Crops (SFCs) has been neglected. Most of these crops traditionally have been

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grown under a system of subsistence farming in the Dry and the Intermediate Zones. During the recent past a shift has occurred in the cultivation of these crops from chena system to a more settled form of agriculture. These are presently cultivated under rainfed condition during the *Maha* Season and under rainfed and/or with limited irrigation during the *Yala* Season in the Dry and the Intermediate Zones. The cultivated area of greengram, red onion, paddy and maize have significantly increased during 1980 – 89. Chilli, groundnut and soybean recorded slight increase in extent cultivated while cowpea and gingelly extents decreased during the same period. Except for 15% and 10% increase in yields observed in paddy and chilli respectively the yields of all other important crops declined during this period. Gingelly and groundnut reported the highest decrease, around 70% and 50% respectively.

The problem

The staple food of Sri Lankans,rice,alone cannot provide all the nutritional requirements of the population.In the cace of cereals only around 90% of the recommended level is met from rice,wheat and other cerials. With regards to pulses the present local production provides only around 35% of the requirements recommended by the Medical Research Institute of Sri Lanka (MRISL). This shows the room to expand the OFC production in the country.

During the recent past the cost of production of paddy has significantly increased but the price of paddy has not increased to compensate the increases in costs. Technical potential exists for the development of agro – based industries using OFCs. Such industries could help to solve the problem of low income of farmers. The development of OFC sector can make a substantial contribution towards solving above problems. More emphasis therefore should be given to expand the production and consumption of OFCs.

The food demand structure explains the food expenditure pattern of the consumers and how substitution and income effects would change the consumption patterns. Demand structure for SFCs, therefore, would be useful as it would enable us to determine the effect of future changes in food policy on consumption pattern of SFCs and in terms of the estimation of the food supply requirements of the country.

Objective

The specific objective of this study is to develop the best fit regression model to explain the demand for cowpea, gingelly, greengram and groundnut. The elasticities and the cross elasticities estimated will be used for interpretation of food policy implications in the country.

METHODOLOGY

Conceptual model

Demand for cowpea, gingelly and greengram consists of food demand, seed demand, stock demand, import demand, price equation and production identity. The demand for groundnut included feed demand in addition to the above mentioned demand categories.

Analytical model

Each of the demand functions was fitted using time series data for the period 1970 – 88 as follows:

1. Food demand function.
   QD1 = F (PD, PS, I, T)

   Where:
   QD1 = Annual per capita direct consumption of the commodity (kg);
   PD = Price of the Commodity deflated by the GDP deflator (Rs/kg);
   PS = Price of the substitute deflated by the GDP deflator (RS/Kg);
   I = Annual per capita income (Rs); and
   T = Time Trend.

2. Feed demand function can be categorised as following for different animal feeds.

2.1 Cattle feed demand function.
   QD2c = F (PD, PLc, Pp, Cc)

2.2 Poultry feed demand function.
QD2p = F (PD, PLp, Pp, Cp)

2.3 Swine feed demand function.
QD2s = F (PD, PLs, Pp, Cs)

Where:
QD2 = Quantity of the commodity used in different feed industries (MT) and c,p and s stand for cattle, poultry and swine respectively.
PL = Price of the livestock product deflated by the GDP deflator (Rs/kg);
Pp = Price of the substitute that can be used in the feed industry, deflated by GDP deflator (Rs/kg); and
C = Annual per capita consumption of different animal products (kg).

3. Stock demand function
QD3 = F(qD3t-1, QS, PD)

Where:
QD3 = Annual carry-over stock of the commodity(MT);
QS = Total production of the commodity (MT);

4. Import demand function.
QD4 = F(QD3, PI, PD, T)

Where:
PI = World market price of the commodity deflated by GDP deflator (Rs/kg);
QD4 = Quantity of the commodity annually imported (MT);

5. Price equation.
PD = F(QD1, QD2, QD3, QD4, QD5)

Where:
QD5 = Total quantity of the commodity annually used as seed (MT);

6. Seed demand equation/identity.
   QD5 = Ae * Sr

   Where:
   Ae = Annual extent of the crop targeted for cultivation ('000 ha); and
   Sr = Seed rate of the crop (kg/ha).

7. Production identity
   QS = (QD1 + QD2 + QD3 + QD5 + w) - (QD4 + QD3t - 1)

   Where:
   W is Wastage of the commodity (MT).

Equation (1) indicates that the quantity of the commodity directly used as food is a function of the price of the commodity, price of the substitute, per capita income and time trend. It is hypothesised a negative relationship between the price of the commodity and the quantity used as food and positive relationships between the quantity used as food and the price of the substitute, per capita income and time trend. Feed demand of the commodity is determined by the price of the commodity, price of the livestock product, per capita consumption of the livestock product and the price of the substitute that can be used in feed industry (Equation (2)). A negative relationship is hypothesised between the quantity used in feed industry and the price of the commodity and positive relationships are expected between the quantity used in feed industry and the rest of the independent variables. Equation (3) represents carry-over stock of the commodity as a function of the carry-over stock of the previous year, total local production of the commodity and the local price of the commodity. The lag commodity stock is hypothesised to be positively related to the carry-over stock as the policy of the government is to build up its buffer stock. Higher the total production the higher would be the carry-over stock and the lower the price of the commodity the higher would be the commodity stock in the country.

As explained in equation (4) imports depend on the local price of the commodity carry-over stock and world market price of the commodity. It is hypothesised a negative relationship between the quantity of the commodity imported and the world market price of the commodity and a positive relationship between the quantity imported and the local price of the commodity. A negative relationship is hypothesised between the quantity imported and the commodity stock in the country.Price of the commodity depends on food demand, seed demand,stock demand and import demand of the commodity (Equation (5). All of these relationships except the price and the import demand are expected to be negative.

Three types of functions,namely food demand function,price equation and production identity were fitted and in the absence of data stock demand function and feed demand function were not estimated.Data on carry-over stock of the SFCs was not available. Carry-over stock in the year (t) is therefor eassumed to be equal to the carry-over stock of the year (t-1).

Method of estimation

The demand model consists of a system of simultanious equations and hence the use of Ordinary Least Square(OLS) method would result simultanious bias in the model. The additive error terms of the equations in the system were assumed to be distributed with zero mean and constant variance. An iterative Seemingly Unrelated Regression (SUR) was applied to estimate the structural parameters (Kmenta, 1986).

RESULTS AND DISCUSSION

Demand for Cowpea

Of the functional forms fitted, the simple linear form gave the best results of the model. In the food demand function signs of the coefficients of the price of cowpea, price of mysoor dhal, per capita income and trend variable were according to the theoretical expectation (Table 1). For example, negative sign of the coefficient of the cowpea price indicated that increase in price of cowpea would result in an decrease in demand for the commodity. Similarly, an increase in price of mysoor dhal would result in an increase in demand for cowpea which indicated that mysoor dhal and cowpea were gross substitutes. The positive sign of the coefficient of the trend variable showed that the demand of cowpea has increased over the years. The price of cowpea and time trend on the food demand function were significant. However

Table 1. Structural coefficients of the demand model

Endo.Var.	Intercept	Explanatory Variables					
1. Cowpea.		PDCOW	PSMDH	PCAPI	TIME	QD1COW	QD5COW
1.1. QD1COW	12.92	-.150	.019	.0002	.502	-	-
		(2.81)	(.73)	(.20)	(3.37)		
1.2. PDCOW	7.14	-	-	-	-	-6.19	0.01
						(2.81)	(2.01)
2. Greengram.		PDGGR	PSCOW	PCAPI	TIME	QD1GGR	QD5GGR
2.1. QD1GGR	-8.22	-.113	.271	2.437	.660	-	-
		(.425)	(1.16)	(1.23)	(2.74)		
2.2. PDGGR	0.361	-	-	-	-	0.775	0.195
						(2.26)	(0.52)
3. Gingelly.		PDGIN	PCAPI	TIME	QD1GIN	QD5GIN	
3.1. QD1GIN	6.78	-.056	.0005	.221	-	-	
	(1.5)	(0.08)	(1.96)				
3.2. PDGIN	9.37	-	-	-	-3.17	0.992	
					(1.04)	(0.35)	
4. Groundnut.		PDGRO	PCAPI	TIME	QD1GRO	QD5GRO	
4.1. QD1GRO	-.453	.164	.040	.204	-	-	
	(.585)	(.016)	(.531)				
4.2. PDGRO	.818	-	-	-	-.63	.038	
					(1.44)	(0.076)	

* Figures in the parenthesis are the t values.

per capita income and price of mysoon dhal were not significant. The price elasticity of demand for cowpea was −2.816. This indicated that 10% increase in the price of cowpea would results in a 28% decrease in demand for cowpea (Table 2).

The elasticity of demand for cowpea with respect to mysoor dhal was 0.435 and this indicated that a similar increase in the price of mysoor dhal would result in an increase in demand for cowpea by 4.3%. The income elasticity of demand for cowpea was 0.238 and this indicated that a similar increase in the per capita income of consumers would results in an increase in consumption of cowpea by 2.38%.

Demand for Gingelly

Out of the different functional forms fitted the simple linear form gave the best results. Sign of the coefficients of all the variables in the food demand function were according to the theoretical expectation. The coefficient of gingelly was negative and this indicated that an increase in price of gingelly would result in a decrease in demand for the commodity. Similarly, positive sign of the coefficient of the per capita income indicated that an increase in per capita income would result in an increase in demand for gingelly. The trend variable was positive and this indicated that the demand for gingelly has increased over the years. All the variables in the food demand function were not significant. The price elasticity of demand for gingelly was −0.436 and this indicated that a 10% increase in price of gingelly would result in a 24% decrease in demand for gingelly. The income elasticity of gingelly was 0.559. This indicated that a 10% increase in per capita income of the consumers would result in a 5% increase in demand for gingelly.

Demand for Greengram

Log − log linear functional form gave the best fit. All the signs of the coefficients of the food demand function were according to the theoretical expectation. Coefficient of the price of greengram was negative and this indicated that an increase in price of greengram would result in the corresponding decrease in the quantity demanded. Similarly, positive sign of the coefficient of price of cowpea indicated that an increase in price of greengram would result in the corresponding increase

Table 2. Simulation of a of a 10% change on the prices of different commodities and income in the demand model.

	Policy Change	Own Price Elasticity	Cross Price Elasticity	Income Elasticity
1.	**Cowpea**	(−2.816)	(0.735)	(0.238)
1.1.	10% increase in cowpea price	−2.817	0.735	0.244
1.2.	10% increase in mysoor dhal price	−2.816	0.735	0.237
1.3.	10% increase in income	−2.816	0.735	0.238
2.	**Greengram**	(−0.113)	(0.271)	(2.437)
2.1.	10% increase in greengram price	−0.114	0.271	2.433
2.2.	10% increase in cowpea price	−0.110	0.266	2.42
2.3.	10% increase in income	−0.113	0.274	2.454
3.	**Gingelly**	(−2.436)	-	(0.959)
3.1.	10% increase in gingelly price	−2.436	-	0.959
3.2.	10% increase in income	−2.435	-	0.960
4.	**Groundnut**	(−0.164)	-	(0.430)
4.1.	10% increase in groundnut price	−0.179	-	0.161
4.2.	10% increase in income	−0.160	-	0.077

Figures in the parenthesis are origional elasticities.

in quantity demanded for cowpea. This indicated that cowpea would be a substitute for greengram.

The positive sign of the per capita income indicated that increase in consumer income would result in an increase in demand for greengram. The positive trend variable showed that demand for greengram has increased over the years. In the food demand function only the trend variable was significant. The price elasticity of demand for greengram was −0.913. This indicated that a 10% increase in price of greengram would result in a 9% decrease in demand for greengram. The income elasticity of demand for greengram was 0.437 and this indicated that a 10% increase in the per capita income would result in an increase in consumption of greengram by 4%. The elasticity of demand for greengram with respect to cowpea was 0.271 and this result indicated that a 10% increase in price of greengram would result in a 2.7% increase in demand for cowpea.

Demand for Groundnut

Of the three functional forms fitted, log−log linear functional form gave the best results. Signs of all the coefficients of the food demand function were according to the theoretical expectation but none of the coefficients was significant. The coefficient of groundnut was negative and this indicated that an increase in price of groundnut would result in the corresponding decrease in the quantity demanded of groundnut. The positive sign of the coefficient of the per capita income showed that an increase in consumer income would result in the corresponding increase in demand for groundnut. Trend variable was positive and this indicated that the demand for groundnut has increased over the years.

The price elasticity of demand for groundnut was −0.164. This indicated that an increase in groundnut price by 10% would result in a 1% decrease in demand for groundnut. The income elasticity of demand was 0.403. This indicated that a 10% increase in per capita income would result in a 4% increase in demand for groundnut.

Conclusion and policy implication

This paper has attempted to estimate the demand model for selected OFCs namely cowpea, gingelly, groundnut and greengram. The methodology adopted was Zellner Seemingly Unrelated Regression. Simple linear functional form was used for cowpea and gingelly while log – log linear functional form was used for groundnut and greengram. The objective of this study is to develop the best fit regression model to explain the demand for cowpea, gingelly, groundnut and greengram.

The findings suggested inelastic own elasticities for groundnut, greengram and gingelly and elastic own elasticity for cowpea. The estimated response to income showed cowpea, gingelly, groundnut and greengram to be normal good with income elasticities less than one. Given these relatively low elasticities demand for these commodities could not be substantially increased (or decreased) in a shorter period assuming realistic adjustments in either or both price and income. There is only a limited scope of short run manipulation of the domestic supply of these commodities through the changes in the market prices.

Given the price inelasticity of gingelly, groundnut and greengram, retailers who sell these commodities will experience increase in total revenue in the face of upward price shifts.If the domestic supply of these commodities increase because of increase in domestic production substantial reduction in the prices of the products will inevitably occur. Although consumers clearly benefit from lower prices benefit from extended production may not necessarily accure to producers.

The low price elasticities have also an intimate bearing on the problem of price stability. As the demand for gingelly, groundnut and greengram was relatively inelastic changes in the conditions of supply of these commodities would bring about disproportionate changes in prices of these commodities. Hence, government should take necessary steps to stabilise prices through different operations.

The results further show that cowpea, mysoor dhal; and greengram, and cowpea were gross substitutes. However there is no close substitute for gingelly and groundnut. The cross price elasticity of cowpea with respect to mysoor dhal was around 0.5 which indicated that the scope for the substitution of cowpea for mysoor dhal was fairly limited.

The OFC food commodities particularly pulses are consumed almost exclusively indirect form although they can be processed in different ways. The processing of OFC food commodities would help to shift the consumer preferences towards OFC food commodities and thereby expand the demand.

As already shown the demand for OFCs is less than what the country requires to consume from a nutritional point of view. The findings of this study showed that gingelly, groundnut, and greengram do not offer good prospects for expansion in their domestic market. Increased food supply and consumer income may not be the complete answer to eliminate malnutrition in the country. Increase in food supply and consumer income must be accompanied by strong emphasis on nutrition education.

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