Factors affecting Import Shares of Powdered Milk and other Milk Products and their Implications in Sri Lanka

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ABSTRACT

Import shares of liquid milk, powdered milk, condensed milk and other milk products were estimated to determine their relative competitiveness. The change of import shares with changes of exchange rate and world price of milk. The analysis based on yearly data between 1975-2006 showed that relative CIF prices and incomes were important factors influencing the market shares of milk and milk products. The results also showed that imported milk powder is price inelastic and a weak substitute for other imported milk products. The milk powder import shares will decline marginally with depreciation of exchange rate by 5% and increase of world price of milk over a forecasted period of 5-7 years. However, these changes are not significant.

Introduction

Sri Lanka is heavily dependent on agriculture which accounted for 17.2% of the Gross Domestic Product (GDP) in 2005. In 2004, the livestock sub-sector has contributed to Rs. 1,539.07 million towards the GDP in agriculture (at current prices). It is estimated that the contribution of the livestock to the agricultural sector is 5.5% of the GDP and 1.2% to the national GDP (Appraisal of the Sri Lanka Dairy Sector, 1999).

In 2002, the milk production in the country was 349 million litres consisting of 266 million litres of cow milk and 83 million litres of buffalo milk; and cow milk production increased by 2% while buffalo milk production decreased by 0.4% in 2003 (Central Bank of Sri Lanka, 2003). In 2005 , the national milk production was 192.7 million litres with 162 million

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litres of cow milk and 31 million litres of buffalo milk and the estimated production for 2007 is 196.6 million litres consisting of 165 million litres cow milk, 32 million litres buffalo milk (Central Bank of Sri Lanka, 2006). The production of domestic milk and milk products is expected to increase from 6.8 to 8.6 million litres between 2006-2007. The average milk production per cow in the country is less than one litre per day whereas in the developed countries the average milk production per cow is over 20 litres per day. For example, in China the average milk yield/cow in a specialized household dairy farm is 5,342 kg as compared to 6,091 kg/cow in a state and collective dairy farms in 2003. Further, the labour efficiency in milk production in Chinese dairy farm is 88.4 kg/man day in private farms and 97.6 kg/man day in state farms (Fuller et al., 2006). In Sri Lanka, the average minimum price of fresh milk is around Rs. 15-20 per litre, which is assumed to be lower than the cost of farm fresh milk production in the country.

The annual per capita consumption of milk in the country is 19.87 litres, which is much below the level of 41.6 litres as recommended by the Medical Research Institute to meet the nutrient requirement of an average Sri Lankan. Hence, there is an urgent need to increase consumption of milk in the country. Further, the current supply of domestic milk production was adequate only to meet 20% of the country's requirement in 2005 and this is expected to increase up to 30% by 2010 (Central Bank of Sri Lanka, 2006). Therefore, the country has to rely heavily on imports of milk and milk products. For example, during the year 2003, 67,941 metric tons of milk and milk based products were imported to the country incurring a cost of Rs.11.5 billion (Central Bank of Sri Lanka, 2003). In 2005, the annual imports of milk amounted to 36,118 metric tons of milk powder or a liquid milk equivalent of 353 litres of milk. Between 1990-2005, the value of milk imports increased from Rs. 2,321.7- Rs 13,041 million (Central Bank of Sri Lanka, 2005) with an annual rate of growth of 30.6%. The principal form of consumption of milk in the country is in the form of whole milk powder (WMP) representing around 90% and pasteurized and sterilized milk accounted for around 3% and condensed milk 2% of the formal milk market. Research studies in Asia have shown that WMP and other milk product prices will increase in the future with increase in imports and Sri Lanka may require to import her requirement of WMP in competition with other milk deficit Asian countries from milk surplus countries such as Australia, New Zealand, China and India. These countries also face milk export reductions with changes in their domestic policies, changes in climatic conditions such as draught and other natural

disasters. Hence, if proper dairy policies towards lifting of the domestic milk industry are not implemented, Sri Lanka may have to spend additional foreign exchange in the future for importing milk and also may face a shortage of imported milk. With such a situation, the domestic prices of imported milk powder will increase beyond the purchasing power of majority of consumers in the country.

The objective of this study is to determine major economic factors affecting import shares of milk and milk products (full cream, non-fat and infant milk powder, condensed milk, liquid milk and cream, butter, cheese, ghee and other milk products) to Sri Lanka between 1975-2002 and to forecast the future import demand for whole milk powder with the changes in exchange rate and world price of milk.

Empirical Model

Import demand share equations were used in analyzing the imports of milk and milk products such as liquid milk and cream (SMMC), condensed milk (SCM), full cream infant and non-fat milk powder (SMP) and butter, cheese, ghee and other forms of value added milk products (SAO). The general form of the import share equations were of the following form,

$$S_{it} = \delta i + \sum_{i} \Phi ij CIF_{pjt} + \theta_i RNGNP_t + \beta_i Exrate_t + \alpha_t trend + \varepsilon_t$$

where,

S_{it} = volume share of supply of imported liquid milk and cream (SMMC), condensed milk (SCM), full cream, infant milk powder(SMP), butter, cheese, ghee and other milk products (SAO) in thousand metric tons at time t.

CIF_{pjt} = avearge unit import value (CIF prices) of imported liquid milk and cream (NSMMCP), condensed milk (NSCMP), whole milk, infant milk powder (NSMP), butter, cheese, ghee and other milk products (NSAOP) normalized by the unit import value of SMP at time t;

$RNGNP_t$ = Real GNP normalized by the unit price of SMP in time t
$Exrate_t$ = Nominal Exchange rate of SL rupee with the US dollar in time t

trend = tine trend

ε_{it} = stochastic error term

The study uses time series data collected between 1975-2002 from different sources such as Central Bank of Sri Lanka, Department of Census and Statistics, Department of Animal Production and Health, Department of Customs, and Food and Agriculture Organization Commodity Bulletins.

Import share equations for liquid milk and cream, condensed milk, full cream and infant milk powder and other milk products were fitted in the above form and the system of 4 equations were simultaneously estimated by Cochrane-Orcutt procedure using SHAZAM software (White, 1997). The impact of exchange rate and world price of milk on the import share equations were determined by using simulation procedure of SIMETAR (Richardson, 2006) using the values of the base simulation and policy simulations.

The homogeneity conditions were imposed on the import share equations where all prices and income were normalized by WMP prices. The import market share of each milk product depends on their relative prices, income, exchange rate and trend. The equations also assumed that imported milk products are separable from domestically produced milk products (Deaton and Muellbauer, 1980) and these products are potential substitutes (Armington, 1969). These equations also assume that all prices and income are exogenous as the total milk imports to the country are relatively small individually or jointly as compared to other foods such as rice, wheat flour, sugar etc. Since all the import share equations have the same set of variables in the right hand side, there is no efficiency gain from systems estimation and hence each market share equation were estimated individually. Due to concerns of non stationarity of the time series data used unit root tests were applied based on augmented Dickey-Fuller procedure. The results indicated that all the data used were stationary. The lagged response to changes of the equations was also tested. The use of volume shares (as opposed to cost share as in AIDS model) is a common measure of market share and competitive market position in marketing literature. The system of equations were estimated by using Cochrane-Orcutt procedure provided in Shazam (White, 1997) to account for autocorrelation of order 1 (AR1) and the results are discussed below.

Results and Discussion

The annual per capita consumption of milk of Sri Lanka has grown by nearly 200% from 13kg/year to 36kg/year since 1981. However, it is somewhat higher than the average consumption of developing countries (32.9 kg/year/capita). Milk importation data showed an increasing trend for the last few decades (Table 1). Nearly 94% of the total milk imports is in the form of powdered milk in bulk form and locally packaged for distribution among consumers.

Table 1: Import of milk and milk products 1989-2002 (metric tons)

Year	Liquid milk and cream	Milk powder	Condensed milk	Other milk products	Total
1989	304.2	34590.0 (93.7)	194.7	1813.5	36902.5
1990	1.8	29115.2 (86.9)	27.0	4363.5	33507.5
1991	3.2	39338.8 (91.9)	29.4	3452.6	42824.0
1992	42.7	39253.6 (91.6)	239.0	3540.0	42867.5
1993	2.2	26846.8 (58.7)	31.2	18850.9	45731.1
1994	61.6	44908.8 (91.6)	447.1	3656.0	49043.5
1995	87.6	47220.8 (93.9)	284.0	2691.9	50284.3
1996	119.0	42770.3 (92.7)	309.5	2942.3	46141.1
1997	169.2	41484.5 (92.7)	250.0	2841.4	44745.1
1998	273.0	53609.8 (93.9)	248.3	2953.3	57084.4
1999	479.8	54050.7 (93.0)	165.3	3424.9	58120.7
2000	185.1	56814.8 (97.7)	83.8	1047.3	58131.0
2001	136.2	52125.6 (95.4)	76.8	2288.1	54626.7
2002	278.9	61929.4 (94.1)	74.9	1671.0	65792.2

* Numbers in brackets show the percentage of milk powder imports of total milk imports.

Results of the Econometric Estimation

Table 2 shows the estimated results of the import share equations as estimated by least squares for the period 1975-2002. The estimated regression equations explain between 74-90% of the variations of the imported market shares of milk and milk products. Most of the estimated price coefficients have the theoretical expected signs i.e. the own price coefficients are negative while the estimated cross price coefficients are positive. The former results are consistent with the law of demand while the latter indicates that the imported shares of products are substitutes. However, some of the price and cross price coefficients were not statistically significant (e.g. price of liquid milk and cream in SMMC equation, price of milk powder in SMP equation, cross price effects in SAO equation). The income coefficients are of the expected signs and are statistically significant (except income coefficient in SMP equation) which indicate that these milk products are normal goods.

The coefficients for exchange rate indicated that with depreciation of the exchange rate the import shares of milk/milk products would decrease as expected but not significantly (exception for condensed milk import share equation).The trend import shares for liquid milk cream and other milk products import shares were negative.

Table 3 shows the estimated import demand elasticities calculated at sample means. These elasticities are the percentage changes in import shares of milk /milk products with respect to a 1% change in either prices or GNP (income). In general prices and income changes may affect the imported market shares of milk/milk products in varying degree. The milk powder (SMP) and other milk product (SAO) shares are inelastic with respect to both prices and income changes. However the liquid milk, cream (SMMC) and condensed milk (SCM) shares are elastic with respect to price of milk powder (NSMP) and income (RGNP). For example, a 1% increase in price of milk powder will increase the import shares of SMMC and SCM by 3.6% and 1.4% respectively. Comparatively a 1% increase in their own price would result in 0.025 % and 0.03% decrease in the import shares of SMMC and SCM respectively. The income elasticity of SMMC and SCM is 6.7 and 3.4 respectively as compared to 0.01 for SMP and 0.9 for SAO respectively.

Table 2: Results of the estimation of milk import share equations

Variables	Liquid Milk, Cream SMMC	Condensed Milk SCM	Milk powder SMP	Other milk Products SAO
CIF price of liquid milk and cream	-0.392 (0.304)	0.417* (0.192)	0.158** (0.056)	0.066 (0.073)
CIF price of condensed milk	0.358 (0.494)	-0.768* (0.312)	0.225* (0.091)	0.014 (0.118)
CIF price of milk powder	8.286** (3.301)	4.384* (2.085)	-0.752 (0.605)	0.928 (0.788)
CIF price of milk powder	1.295** (0.382)	0.558* (0.241)	0.058 (0.070)	-0.816** (0.091)
RNGNP	7.124* (3.552)	4.953* (2.244)	0.025 (0.651)	1.679* (0.747)
Exrate	-3.226 (2.683)	-5.173** (1.695)	-0.479 (0.492)	-0.844 (0.640)
Trend	-1.145** (0.455)	0.141 (0.287)	0.116 (0.083)	-0.188 (0.109)
Intercept	-77.941* (32.656)	51.256* (20.628)	16.247** (5.986)	-3.623 (7.791)
R^2	0.844	0.739	0.858	0.903
Rho	0.454	0.152	0.245	0.453
D.W	2.897	1.670	1.897	2.660
F	15.511	8.077	17.795	26.597

*,** : significant at 5% and 1% level respectively
Note: Figures in parenthesis are the standard errors.

Table 3: Estimated share demand elasticity of milk and milk products at the mean

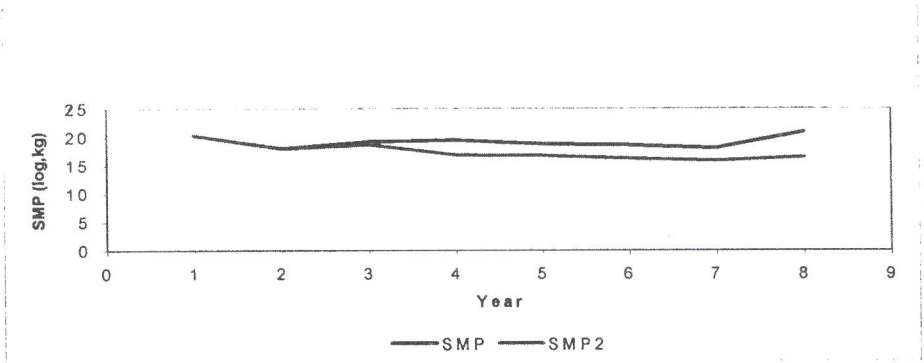
Import shares	CIF prices of				RNGNP
	Liquid milk & cream	Condensed milk	Milk powder	Other milk products	
SMMC share	-0.025	0.021	3.583*	0.016*	6.729*
SCM share	0.019*	-0.033*	1.376 *	0.005*	3.396*
SMP share	0.012*	0.005*	-0.071	0.00009	0.012
SAO share	0.003	0.001	0.247	-0.006*	0.976

*: significant at 5% level

Results of the Simulation Analysis

The above econometric results were used to simulate the impacts of depreciation of exchange rate and an increase in CIF price of milk on milk powder imports. The baseline equilibrium indicates that milk powder imports share is nearly 90% of the overall imports of milk/milk products to the country and the exchange rate has also being depreciating over time. Figure 2 presents the resulting change in import of milk powder due to a depreciation of exchange rate by 5%. The SMP import shares decline with depreciation of the exchange rate marginally over forecasted period of 5-7 years.

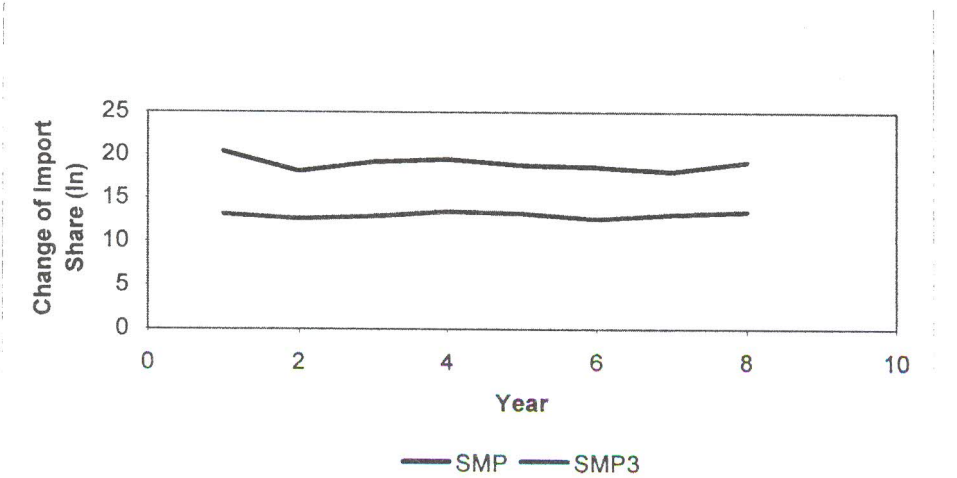
Figure 2: Change of import share of milk powder with a depreciation of exchange rate by 5%



Note: SMP: Level of SMP share in the base simulation;
SMP: Level of SMP share with 5% depreciation of exchange rate

Figure 3 shows the impacts of an increase in CFI price of SMP by 5% on the import share of milk powder for a forecasted period of 5- 7 years (Figure 3).

Figure 3: Change of import share of milk powder with a 5% increase in the price of milk.



Note: SMP: Base simulation level of SMP; SMP3: Policy simulation (5% increase in the price of SMP)

Conclusions and Policy Implications

The results indicate that imports of milk powder would decrease due to increase of world price and devaluation of currency. The domestic price of imported milk powder will continually increase due to inflation, higher energy prices, and foreign debt. With milk powder being price inelastic and with weak substitutes (low cross price elasticity with other milk products) the demand for imported milk powder will remain high in the country. Measures to increase the domestic production of milk, processing, marketing and distribution in the country will be required to fulfil the growing demand.

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