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Impact of Milk Powder Imports on Local Milk Industry and Consumers' Welfare in Sri Lanka

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ABSTRACT

This paper examines the economic effects of milk powder imports on domestic milk industry and consumers' welfare. Domestic milk production fullfilled around 40% of the demand in 2016. The generalized inverse demand system model was employed. The result shows that a 10% increase in milk powder imports increases consumers' welfare by USD 20 million and fresh milk and local milk powder industry will suffer economic losses. Therefore, until domestic producers develop the capacity to compete with international competitors, government should provide subsidies, credit facilities and technical assistance to all dairy farmers, middlemen, milk collecting centers, dairy farmers associations and cooperatives involved in domestic dairy industry. Government should provide assistance and facilities to domestic fresh milk processors to promote fresh milk consumption by non-price competition strategy. Importers of milk products and local milk processors could use this finding to develop their business strategy.

Keywords: Consumer Welfare, Generalized Inverse Demand System Model, Import of Milk Powder
JEL Classifications: Q11, Q17, Q18

1. INTRODUCTION

The dairy sector is considered as a potential sector to contribute significantly to Sri Lanka's economic development. The dairy industry in Sri Lanka plays an important role in alleviating nutritional poverty and creating employment opportunities. Smallholders dominate the livestock industry which provides income, quality food, fuel, draught power and fertilizer, thereby contributing to household livelihood, food security and nutrition. The sector contributed 88 billion rupees to the GDP. It is around 0.75% of GDP in 2016. The current annual milk consumption in Sri Lanka is around 700 million liters per annum and annual per capita consumption is around 35 liters per annum. Per capita consumption of milk and milk products in Sri Lanka is lower than in other South Asian countries. The current national milk production of 330 million liters comprises of 180 million liters collected by the formal market and 150 million liters sold through the informal market. The shortfall of 370 million liters is met by imports, mostly in powder form. Thus, locally produced milk meets only around 40% of the demand for national consumption in 2016. Before Sri Lanka introduced open economic policy in 1977, the local milk production fulfilled the 80 percent of local demand in Sri Lanka. But, with the advent of trade liberalization, the increasing demand for milk product led to increase the imports of milk and milk products. As a result, local milk production only fulfills around 33 percents of domestic consumption requirement by 2009. Thus, Sri Lanka heavily depends on milk imports, mainly as powdered milk to fulfill this gap of demand. Sri Lanka imported 5,000 MT of milk powder 25 years ago, but it increased to almost 85,000MT in 2012 (Nanayakkara, 2013). Value of the imported milk products in 2014 was around USD 400 million. Thus, a significant part of the foreign exchange is leaked from the country (Nathaniel, 2014). There is a need for expansion of dairy production in Sri Lanka since country depends mainly on imports to fulfill the domestic demand requirement for dairy products. Domestic production of milk powder is 11.610 MT and the importation of milk powder is 89.910 MT (Department of census and statistics, 2013). Since the adaption of liberal economic policy in Sri Lanka, the local dairy industry is highly influenced by the international milk prices.

After opening Sri Lankan economy for international trade, import duties on milk powder increases the price of imported milk powder and then reduces the consumer surplus. As it negatively influenced welfare of consumers, only infant milk foods were exempted from duties in 1984. In 2002, the import duties on all milk foods were reduced to bring down the cost of living (Mendis and Edirisinghe, 2014). Private milk powder suppliers play a significant role in Sri Lankan milk powder market. Government imposes price ceilings to milk powder to protect local consumers from the price increase in the international market. The Government involves in milk industry through the state-owned milk processing company Milco, which collects milk from farming areas, processes and market it under the Highland brand. On the other hand, a significant amount of milk is marketed through the informal channels, because of lack of coverage of the formal milk collection network and its high costs and quality problems (Hitihamu et al., 2007). The main constraint of milk producers is the marketing of their product. There is not efficient marketing channel. Because milk is perishable and it needs special container to prevent spoiling while transporting to milk processing center and smallholder dairy farmers are scatted over the rural areas, middlemen need to invest heavily in the fixed input. As the importation of milk powder reduce profit margin of middlemen, middlemen's participation in the marketing channel is very poor. Therefore, Milk producers need to act collectively to overcome this constraint by securing a market. It can be achieved by dairy farmers cooperatively establishing their own collection system and milk processing units to convert their perishable fresh milk into products with longer-keeping quality. It is very important to make policies that increase domestic production as well as consumers' welfare. Policy makers need to know the impact of import of milk powder on domestic dairy industry and consumers welfare to make appropriate policy to develop domestic dairy industry. The main objective of this study is to estimate the impact of imported milk powder on the price of fresh milk and local milk powder and consumer welfare. In order to achieve this objective, this study used a system of inverse demand equations in which price variations are explained by function of quantity variations.

2. METHODOLOGY

A system of inverse demand functions is increasingly being used in the demand analysis of food commodities. The system of inverse demand approach is useful in markets for agricultural products where quantities available are regarded as being predetermined rather than as being adjusted in the short run (Lee and Kennedy, 2008). In an inverse demand function, price is a function of quantity demanded. Two different approaches have been used to develop inverse demand systems. Rotterdam methodology is a direct approximation of the conceptual inverse demand relationships and imposes no rigid assumption on the utility function (Barten and Bettendorf, 1989). Rotterdam method develops the inverse demand systems which explain the quantity effect on price in terms of the substitution effect and the scale effect. Distant function method is based on a dual representation of preferences which specify the functional form of the direct utility function, Kim (1997), Beach and Holt (2001), Holt and Bishop (2002), and Wong and McLaren (2005). Barten and Bettendorf (1989) developed the four different types of inverse demand systems, Differential Inverse Rotterdam Demand System (DIRDS), Differential Inverse Almost Ideal Demand System (DIAIDS), Differential Inverse Central Bureau of Statistics (DICBS), and Differential Inverse National Bureau of Research (DINBR) by using Rotterdam method, assuming weak separability of the commodity bundle into eight fishery products and collective consumer behavior as a rational representative consumer. Subsequently, Brown, Lee, and Seale (1995) have developed generalized inverse demand system, nesting these four inverse demand systems.

Several researchers have used the generalized inverse demand systems for empirical analysis. If direct utility function is quasi-concave in quantities and the indirect utility function is quasi-convex in prices and the expenditure function is concave in prices, then the inverse demand system can be used to welfare effect analysis of price change. Price is the endogenous variable in an inverse demand function, but it is the exogenous variable in traditional demand function. An inverse demand system is more desirable for analysis of demand for perishable products. Even though these products can be stored either in a frozen state or as processed goods, the life span of these products should be limited. Since the quantities of commodities available at the market are predetermined by production, quantities can be considered as exogenous at the aggregate level. In order to be consumed the available quantities at the market, prices must be adjusted. Individual consumers make their consumption decisions based on given prices. This implies that quantity-based measures may be more appropriate for analyzing welfare of consumers at the aggregate level even though price-based measures are useful for analyzing the welfare of individual consumers. In an inverse demand system, compensated price flexibility and scale flexibility describes the substitution effect and the income effect respectively. The uncompensated price flexibility is the sum of compensated price and scale flexibilities. A family of inverse demand systems is used in this study

$$w_i dlnp_i = b_i dlnQ + \sum_j b_{ij} dlnq_j \qquad \text{(GIDS)} \qquad (1)$$

$$w_i dlnp_i = h_i dlnQ + \sum_j h_{ij} dlnq_j \qquad \text{(DIRDS)} \qquad (2)$$

$$dw_i = e_i dlnQ + \sum_j e_{ij} dlnq_j \qquad \text{(DIAIDS)} \qquad (3)$$

$$w_i dln\frac{p_i^*}{P} = e_i dlnQ + \sum_j h_{ij} dlnq_j \qquad \text{(DICBS} \qquad (4)$$

$$dw_i - w_i dlnQ = h_i dlnQ + \sum_j e_{ij} dlnq_j \qquad \text{(DINBR)} \qquad (5)$$

$$p_i = \frac{p_i^*}{M}, \quad q_i = \frac{q_i^*}{q_{i.mean}}$$

Where, p_i is the normalized price of the i th good. p_i* is the nominal price of the ith good. q_i is the normalized quantity of the i th good.

qi^* is the quantity of the i th good. $q_{i,mean}$ is mean of the quantity of the i th good. $w_i = p_i q_i$ is the i th good's budget share. $\sum_i w_i dlnq_i = dlnQ$ is a differential Divisia quantity index, and $\sum_i w_i dlnp_i = dlnP$ is a differential Divisa price index. b_i, h_i and e_i represent the move from one difference surface to another, implying scale effect. $b_{i,j}$, h_{ij} and e_{ij} represent a movement along the same indifference surface, implying substitution effect. This nesting system of equations is called the Generalized Inverse Demand System (GIDS).

$$w_i dlnp_i = \sum_j \gamma_{ij} dlnq_j + \gamma_i dlnQ - \theta_i w_i dlnQ - \theta_2 w_i dln(q_i / Q)$$

$$= \sum_J \left(\gamma_{IJ} - \theta_2 w_i \delta_{ij} + \theta_2 w_i w_j\right) dlnq_j + \left(\gamma_i - \theta_1 w_i\right) dlnQ$$

$$= \sum_J \left(\gamma_{IJ} - \theta_2 w_i \delta_{ij} + \theta_2 w_i w_j\right) dlnq_j + \left(\gamma_i - \theta_1 w_i\right) dlnQ \quad (6)$$

$$\gamma_{ij} \equiv \left(1-\theta_2\right) h_{ij} + \theta_2 e_{ij} \text{ and } \gamma_i \equiv \left(1-\theta_1\right) h_i + \theta_1 e_i \quad (7)$$

The restrictions of adding up, homogeneity, and symmetry can be imposed for equation as follows:

$$\sum_i \left(\gamma_{ij} - \theta_1 w_i\right) = -1 \quad \text{(Adding up)} \quad (8)$$

$$\sum_i \left(\gamma_{ij} - \theta_2 w_i \delta_{ij} + \theta_2 w_i w_j\right) = \sum_i \gamma_{ij} = 0 \quad \text{(Adding up)} \quad (9)$$

$$\sum_j \left(\gamma_{ij} - \theta_2 w_i \delta_{ij} + \theta_2 w_i w_j\right) = \sum_j \gamma_{ij} = 0 \quad \text{(Homogeneity)} \quad (10)$$

$$\gamma_{ij} = \gamma_{ji} \quad \text{(Symmetry)} \quad (11)$$

The scale and price flexibilities can be derived easily from equation.

$$f_i = \gamma_i / w_i - \theta_1 \quad \text{(Scale flexibility)} \quad (12)$$

$$f_{ij}^* = \gamma_{ij} / w_i + \theta_2 w_j \quad \text{(Compensated cross-price flexibility)} \quad (13)$$

$$f_{ij}^* = \gamma_{ii} / w_i - \theta_2 + \theta_2 w_i \quad \text{(Compensated own-price flexibility)} \quad (14)$$

$$f_{ij} = f_{ij}^* + w_j f_i \quad \text{(Uncompensated price flexibility)} \quad (15)$$

Price flexibility is the percentage change in price for one percent change in quantity, other things being equal. If demand is inelastic, then the absolute value of the indirect price flexibility coefficient is greater than one. If demand is elastic, then the absolute value of the price flexibility coefficient is <1. The cross price flexibility of commodity i with respect to commodity j is the percentage change in the price of commodity i for a one percent change in the quantity of commodity j, other things being equal. The cross price flexibility of a substitute is expected to be negative. A larger quantity of a commodity lowers the price for its substitute commodity and then decreases demand for the first commodity. The lower demand implies a reduction in price. The price flexibility of income is the percentage change in price for a one percent change in income.

Consumer welfare can be measured by consumer's surplus of uncompensated inverse demand. The uncompensated flexibility measures the sum of substitution and scale effect. As the uncompensated flexibility overestimates the quantity effect on price, consumer surplus is only an approximated measurement. Compensated price flexibility measures exactly the substitution effect. As a result, compensating variation will be used to exactly measure the effect of imports on consumer welfare. When quantity changes, consumers may be better off or worse off depending on price and scale flexibilities. Consumer welfare can be measured by three means such as consumer's surplus (*CS*), compensating variation (*CV*) and equivalent variation (*EV*). Uncompensated flexibility is used to measure CS, whereas compensated flexibility is used to measure CV and EV. When utility function of consumers is quasi linear, consumer surplus can be an exact measure of welfare change. As uncompensated flexibility includes both substitution and scale effects, the consumer surplus overestimates the quantity effect on price. Therefore, CS is only an approximated measure of welfare change. However, compensated flexibility exactly measures the substitution effect. As a result, compensating or equivalent variation can be used to exactly measure the effect of imports on consumer welfare. Figure 1 shows *CV* and *EV* in quantity space and Figure 2 shows the difference between *CS* and *CV* or *EV*.

The new price resulting from a change in quantity can be calculated, using uncompensated flexibility, as follows:

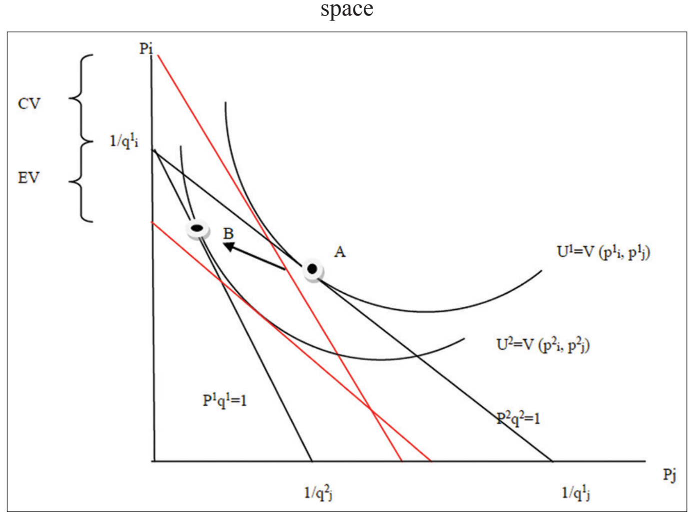
$$p^2 = p^1 + ep = p^1 \left[1 + \left(flexibility\right) \times \left(\frac{\Delta q}{q^1}\right)\right] \quad (16)$$

CV is associated with a change in quantity from q^1 to q^2. *CV* is calculated, using compensated flexibility, as follows:

$$CV = \Delta q \left[p^1 + 0.5\left(comp.flexibility \times \frac{p^1}{q^1}\right)\Delta q\right] \quad (17)$$

The area (*a*+*b*+*c*+*d*) in Figure 2 is *CV*. *CV* is the amount of additional (normalized) expenditure the consumer would need to

Figure 1: Compensating variation and equivalent variation in quantity space



reach the initial utility level, u^1,after a change in the amount of quantity from q^1 to q^2. The equivalent variation (EV) of a change in the quantity from q^1 to q^2 is calculated, using compensated flexibility, as follows:

$$EV = \Delta q\left[p^2 - 0.5\left(comp.flexibility \times \frac{p^1}{q^1}\right)\Delta q\right] \quad (18)$$

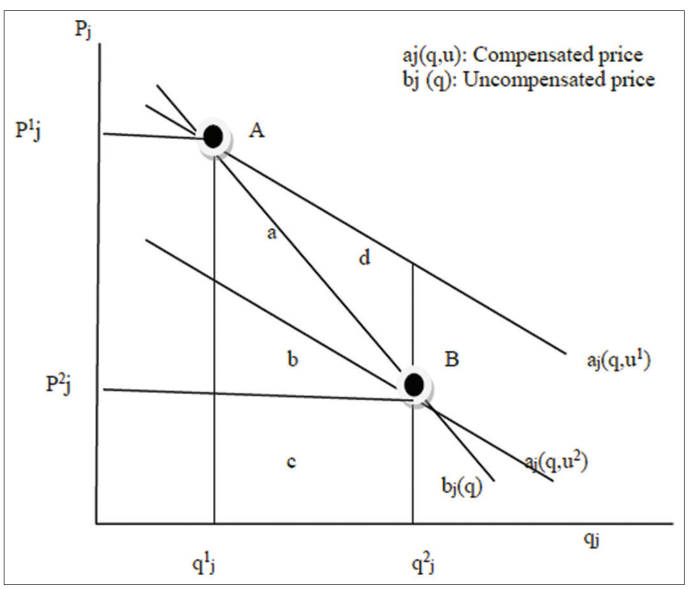
The area (b+c) in Figure 2 is EV. EV is the amount of additional (normalized) expenditure the consumer would need to maintain the new utility level of u^2 while facing the initial quantity of q^1.Consumer's surplus is estimated from uncompensated inverse demand functions. The quantity-based change in consumer surplus (CS) area (a+b+c), is calculated, using uncompensated flexibility, as follows:

$$CS = \Delta q\left[p^1 + 0.5\left(uncomp.flexibility \times \frac{p^1}{q^1}\right)\Delta q\right] \quad (19)$$

The uncompensated inverse demand curve is steeper than the compensated curve for a normal good. It implies that the CS associated with a change in quantities is greater than EV and less than CV ($EV<CS<CV$).When preferences are homothetic, there is no scale effect for quantity change. It implies that CS is a relevant welfare measure for quantity changes. However, Homothetic preferences are unrealistic, and generally commodity demands have scale effects. This implies that CS is approximate welfare measure for quantity changes relative to CV or EV.

Annual data for price and quantity of fresh milk, local milk powder, and imported milk powder which were available from 1998 to 2012 in Agricultural and Environmental Division of Department of Census and Statistics when this research carried out in 2015 were collected. Consumer Price index for Food item and Average Retail Price of milk product were collected from Central Bank of Sri Lanka. Average Retail Price of Lakspray

Figure 2: Welfare measures of change in quantity



and Anchor were considered as Average Retail Price of local and imported milk powder respectively. Consumer price index was used to deflate the average retail price and get real price for fresh milk, local and imported milk powder. The price data were normalized before being used in the logarithmic equations of inverse demand systems. Quantities are divided by their sample mean before the logarithmic transformation. As a result, flexibilities will be estimated at quantity mean value. If the disturbance in each equation is correlated with each other, single-equation least squares estimators offer inefficient estimators, but system of estimation procedure provides efficient coefficient estimators at least asymptotically. This study will employ a restricted Seemingly Unrelated Regression (SUR) as Zellner (1962) described. The restriction such as adding-up, symmetry, and homogeneity conditions can also be imposed.

3. RESULTS AND DISCUSSIONS

It is important to determine which of the nested inverse demand systems fits better for the data. Table 1 shows the estimated parameters of θ1 and θ2. These θ1andθ2 are statically different from 0 and 1. This indicates that data fit for GIDS model.

Table 2 shows the result of GIDS Model. The last column of Table 2 gives the coefficients of determination (R^2) as an indicator for model fit and Durbin-Watson statistics as an indicator of first-order autocorrelation. None of the equations appear to have first-order autocorrelation in the GIDS model. The compensated price flexibilities and scale flexibilities are given in Table 2.

The estimated scale flexibilities are negative in sign as expected. While the p_i*, absolute prices stay constant, if aggregate quantity increases, the normalized price goes down. It means an increase in the aggregated quantity increase total expenditure m, hence a decrease in the normalized price, $p_i = p_i^*/m$. The scale coefficients γ can be converted into scale flexibilities by using the formula for scale flexibilities. All the estimated own price flexibilities are negative. Table 3 shows the uncompensated price flexibility of GIDS model. The absolute values of own uncompensated flexibilities are greater than the absolute values of own compensated flexibilities because of negative values of scale flexibility and own compensated price flexibility. The absolute values of cross uncompensated flexibilities depend on the sign of the value of cross compensated price flexibility.

If the cross compensated price flexibility is positive, then the absolute value of cross uncompensated price flexibility is less than the absolute value of cross compensated price flexibility. It implies the scale effect reduce the substitution effect. Uncompensated price flexibility is the sum of both compensated price flexibility and scale flexibility. Estimated own uncompensated price

Table 1: Estimated mixing parameter

Mixing parameter	Standard error
Θ1=0.846620	0.117121
Θ2=0.587708	0.140856

Table 2: Scale and compensated price flexibility of GIDS

Equation	Scale flexiblity	Fresh milk	Local powder	Imported powder	R2/DW
Fresh milk	−1.59***	0.76**	0.06	0.701**	0.25/1.99
	(0.0025)	(0.0548)	(0.3757)	(0.0420)	
Local Powder	−2.05***	0.149	−1.212***	1.063***	0.55/2.19
	(0.01)	(0.3757)	(0.0118)	(0.0128)	
Imported powder	−1.9***	0.194**	0.495***	0.313***	0.53/1.86
	(0.001)	(0.042)	(0.0128)	(0.0147)	

p-value in parentheses, ***Significant at 1% , **Significant at 5%

Table 3: Uncompensated price flexibility of GIDS

Equation	Fresh milk	Local powder	Imported powder
Fresh milk	−1.08**	−0.07	−0.44
	(0.021)	(0.231)	(0.177)
Local powder	−0.26	−1.38***	−0.41
	(0.184)	(0.005)	(0.249)
Imported powder	−0.18*	0.342	−1.68***
	(0.056)	(0.437)	(0.0001)

p-value in parentheses, ***Significant at 1%, **Significant at 5%, *Significant at 10%

flexibility of fresh milk, local milk powder and imported milk powder were -1.08, -1.38, and -1.68, respectively. It indicates that demand for imported milk powder is more inelastic than demand for fresh milk and local milk powder. Due to negativities of own price flexibility and scale flexibility the absolute magnitude of own uncompensated price flexibility is greater than own compensated price flexibility.

All cross uncompensated price flexibilities except cross local milk powder uncompensated price flexibility for imported milk powder shows negative sign. Among the cross uncompensated price flexibilities, cross fresh milk uncompensated price flexibility for imported milk powder is significant at 10% level but insignificant at 5% level. Although cross price flexibilities are insignificant at 5% level, the scale flexibilities of fresh milk, local milk powder and imported milk powder are negative and significant at 1% level. Estimated scale flexibility of fresh milk, local milk powder and imported milk powder were -1.59, -2.05 and -1.9 respectively. Therefore, it can be deduced that an increase in aggregated milk product supply due to the imported milk powder has a strong negative impact on price of fresh milk and local milk powder. In order to measure consumer welfare, the study uses consumer surplus and compensating variation based on uncompensated price flexibility and compensated price flexibility estimated in this model. The result of the study shows that a 10% increase in annual milk powder imports increases consumer surplus by USD 13 million and compensating variation by USD 20 million respectively. Since scale flexibilities are negative and significant at 5% level, there is a scale effect for quantity change. Therefore, compensating variation would be the most appropriate method to estimate the consumer welfare effect of quantity than consumer surplus in this study.

4. CONCLUSION

This study concludes that demand for imported milk power is more inelastic than fresh milk and local milk powder. The result ahows that 10% increase in milk powder imports increases consumer welfare by USD 20 million. The negativity of scale flexibility of fresh milk and local milk powder indicate that fresh milk and local milk powder industry will suffer economic losses from increased imported milk powder. This study will be useful to the policy makers to make appropriate policy to increase local milk production. Until domestic dairy industry develop the capacity and compete with international competitors, government should provide subsidies, credit facilities and technical assistance to dairy farmers, dairy farmers association, dairy farmers cooperatives, milk collecting centers, middlemen, domestic milk processors.

Government should provide assistance and facilities to domestic fresh milk producers to promote fresh milk consumption by non-price competition strategy. Government authorities related to health and nutrition should conduct awareness program to promote consumption of fresh milk such as pasteurized, sterilized and UHT fresh milk. Importers of milk products and local milk processors also could use this finding to develop their business strategy.

REFERENCES

Barten, A.P., Bettendorf, L.J. (1989), Price formation of fish: An application of an inverse demand system. European Economic Review, 33, 1509-1525.

Beach, R.H., Holt, M.T.. (2001), Incorporating quadratic scale curves in inverse demand systems. American Journal of Agricultural Economics, 83, 230-245.

Brown, M.G., Lee, J.Y., Seale, J.L.Jr. (1995), A family of inverse demand systems and choice of functional form. Empirical Economics, 20, 519-530.

Eales, J.S., Unnevehr, L.J. (1994), The inverse almost ideal demand system. European Economic Review, 1, 101-115.

Hitihamu, H.M.S., Samantha, N.P.G., Rathnayake, R.M.G. (2007), Factors Affecting the Cost of Production of Milk. Vol. 32. Sri Lanka: HARTI Newsletter Hector Kobbekaduwa Agrarian Research and Training Institute of Sri Lanka. p3-8.

Holt, M.T., Bishop, R.C. (2002), A semiflexible normalized quadratic inverse demand system: An application to the price formation of fish. Empirical Economics, 27, 23-47.

Kim, H.Y. (1997), Inverse demand systems and welfare measurement in quantity space. Southern Economic Journal, 63, 663-679.

Lee, Y., Kennedy, P. (2008), An examination of inverse demand models: An application to the U. S. crawfish industry. Agricultural and Resource Economics Review, 37(2), 243-256.

Mendis, S.S., Edirisinghe.C.J. (2014), Milk powder imports and government policy: The case of Sri Lanka. Journal of Agriculture Economics and Rural Development, 2(3), 86-91.

Nanayakkara, P. (2013), Liquid Milk: On the Path to Self-Sufficiency. Business Today. Available from: http://www.businesstoday.lk/cover_page.php?issue=262.

Nathaniel, C. (2014), Milk Production in a Quandary? Sunday Leader. Available from: http://www.thesundayleader.lk/2013/06/16/milk-production-in-a-quandary.

Park, H. (1996), Econometric Welfare Evaluation of Regulatory Fishing Restrictions. A Synthetic Inverse Demand Approach. Ph.D Dissertation. North Carolina: North Carolina State University.

Perera, B.M.A., Jayasuriya, M.C.N. (2008), The dairy industry in Sri Lanka: Current status and future directions for a greater role in national development. Journal of National Science Foundation Sri Lanka, 36, 115-126.

Wong, K.K., Mclaren, K.R. (2005) Specification and estimation of regular inverse demand systems: A distance function approach. American Journal of Agricultural Economics, 87, 823-834.

Zellner, A. (1962), An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias. Journal of the American Statistical Association, 57, 348-368