The Poverty and Income Inequality Impacts of South Asian Trade Liberalisation on the Sri Lankan Economy

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The impacts of South Asian trade liberalisation on poverty and income inequality in the Sri Lankan economy are examined using a multi-country computable general equilibrium (CGE) model. A non-parametric extended representative household-agent approach is used to estimate the income inequality and poverty effects using micro household survey data. Two trade liberalisation policy simulations are investigated (i) the formation of the South Asian Free Trade Agreement (SAFTA) and (ii) unilateral trade liberalisation in South Asia. Poverty in Sri Lanka is predominantly rural and the findings suggest that poverty and income inequality is reduced in the urban, rural and estates sectors in Sri Lanka under both trade liberalisation policies.

Keywords: Trade liberalisation, Poverty, Multi-Country Computable General Equilibrium (CGE) model, Non-Parametric Method, Extended Representative Agent Approach

JEL Classifications: F15, F 13, F47, H31, H60

1. Introduction

Sri Lanka, the pioneer of economic liberalisation in South Asia has introduced market oriented policy reforms in 1977. Prior to economic liberalisation, the industrial sector was promoted through protectionists measures such as tariffs, quotas and reservation of certain manufacturing activities to small industries. The post-1977 reforms placed a special emphasis on the role of foreign direct foreign investment in promoting export oriented industrialisation (Dias, 1991).

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Sri Lanka is a lower middle income developing country according to the World Bank classification with per capita income in 2010 estimated at US$ 2400 (Central Bank Sri Lanka, 2010). Similar to most of the other South Asian economies, by 2008, Sri Lanka's total trade equivalent to 54.5 per cent of the GDP and had an average growth rate of 6 per cent during the period of 2004-2008 (Central Bank, 2010). The service sector is the dominant sector in the economy accounting for about 59.5 per cent of GDP and 41 per cent of employment in 2008. The industrial sector accounted for 28.4 percent of GDP and 26.3 per cent of employment while the agricultural sector accounted for 12.1 of GDP and 32.7 per cent of employment in 2008 (Central Bank, 2010). Moreover, it has achieved a high level of human development due to the heavy investments in social infrastructure by successive governments.

Sri Lanka is an original member of the World Trade Organisation and also entered into a number of regional trading agreements (e.g. Bangkok Agreement in 1975, BIMSTEC in 1997). For the past decade, Sri Lanka's trade policy has focused on negotiating a number of bilateral and regional trade agreements to increase its market access to the region (Wijayasiri 2007; WTO,2004; Bouët et al., 2010). Economic integration in the South Asian region commenced with the establishment of the South Asian Association for Regional Co-operation (SAARC) in 1985 by the seven South Asian countries: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. In 1995 and these economies instigated a framework for region wide integration under the South Asian Preferential Trading Agreement (SAPTA). Subsequently, the member countries agreed that SAPTA would commence the transformation into a South Asian Free Trade Area (SAFTA) by the beginning of 2006, with full implementation completed by December 31, 2015. Also it is worth noting that unlike some other South Asian economies Sri Lanka has executed a series of unilateral tariff reductions and also significantly reduce non-tariff barriers (Siriwardana, 2001). Hence, Sri Lanka is relatively low tariff country in comparison to her South Asian regional trading partners.

There is ample theoretical and empirical evidence to support the view that open trade regimes lead to faster growth and poverty reduction in developing countries (Bourguignon and Morisson 1990, Barro, 2000 and Dollar and Kraay, 2004). However, in contrast Annabi et al. (2005), Khondker and Raihan (2004) stated that trade liberalisation produces welfare loss and thereby increases poverty in developing countries.

Although Sri Lanka has achieved substantial economic progress after introducing economic reforms, about 20-30 percent of its population was living below the poverty line over the last decade (i.e. between 1990-2000) (Jayanetti & Tilakaratna, 2005). Hence, there is growing concern among policy makers of Sri Lanka about income distribution and the poverty implications of trade reforms. As per the Official Poverty Line (OPL) for Sri Lanka[2,] using the Household Income and Expenditure Survey (HIES) of the Department of Census and Statistics (DCS), the poverty Head Count Index (HCI) for Sri Lanka in 2009/10 was 8.9 percent which means 1.8 million people were identified as poor. The figures in Table 1 show a decline in aggregate poverty levels during the period of 1990-2010. The fall in poverty is significant in both the urban and the rural sectors. In particular, the percentage of poor has more than halved in the urban sector during the last decade. It also reveals a two third drop of poverty in estates sector[3] which all most equal to the poverty head count ratio reported in the rural sector.

Table 1 Poverty Headcount Index in Sri Lanka from 1990/91 to 2009/10

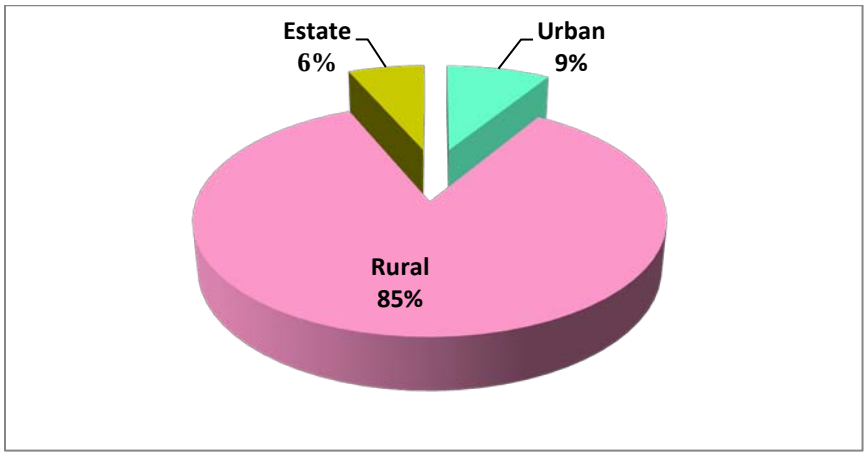
Sector	**Survey Period**			
	1990-91 (%)	**1995-96 (%)**	**2002 (%)**	**2009/10(%)**
Sri Lanka	**26.1**	**28.8**	**22.7**	**8.9**
Urban	16.3	14.0	7.9	5.3
Rural	29.5	30.9	24.7	9.4
Estate	20.5	38.4	30.0	11.4
Source: Department of Census and Statistics (DCS), estimates based on HIES 1990-91, 1995-96, 2002 and 2009-10.				

Furthermore, from Figure 1 it could be noted that despite the declining trend in poverty in Sri Lanka, poverty is predominantly a rural phenomenon.

[2] The Department of Census and Statistics (DCS) introduced the Official Poverty Line (OPL) for Sri Lanka in June 2004. The year 2002 value of the OPL, which was Rs. 1423 real total expenditure per person per month, is updated for the inflation of prices through the Colombo Consumer Price Index (CCPI) calculated monthly by the DCS. According to price index values 3176 in 2002 and 4983 in 2006/07 as reported by the CCPI the value of the OPL for 2006/07 is Rs. 2233 real total expenditure per person per month.

[3] The estate sector is considered to be part of the rural sector. Large plantations growing tea, rubber and coconut were introduced in Sri Lanka during the British colonial period and labour was imported from South India to work on these plantations. These are included in the estate sector, which comprises 5 per cent of the total population in Sri Lanka (World Bank, 2009).

Figure 1 Contribution to Poverty (percentage) by Sector: 2009/10



Source: Department of Census and Statistics (DCS), estimates based on HIES 2009-2010.

Against this background, it is important to investigate in detail, whether trade liberalisation in South Asia and in Sri Lanka itself would result in an improvement in welfare of all parties or only benefit a few groups in society. The aim of this paper is therefore to investigate the impact of two trade liberalisation policies (SAFTA and unilateral trade liberalisation) on income inequality and poverty of different household groups in urban, rural and estate sectors in Sri Lanka. The structure of the paper is as follows. Section 2 reviews the existing CGE studies relating to trade liberalisation and poverty. The methodology of the study is presented in Section 3. The method of Kernel income distribution, poverty and income distribution measures are outlined in Section 4. The results of the analysis are discussed in Section 5. Concluding comments are provided in Section 6.

2. Trade Liberalisation and Poverty : A Survey of Literature

It is acknowledged that sustained economic growth brings about poverty reduction[4]. However, this in itself is inadequate without understanding the nexus between trade liberalisation, poverty and income distribution. One reason is that trade reforms affect individuals in diverse ways including employment, redistribution of resources, change in prices

[4] Bourguignon and Morisson (1990); Li, Squire and Zou (1998); Barro (2000); Dollar and Kraay (2002, 2004) and Lundberg and Squire (2003)

of consumer goods, and changes in government revenues and expenditure (Winters, 2004). Trade liberalisation affects income distribution and poverty in a country through two main transmission channels: changes in the relative prices of factors of production (labor and capital) and commodities. These changes will lead to some households gaining while others will lose. The link between trade liberalisation and poverty and inequality is important for two reasons: firstly, social scientists, economists and society in general all are concerned about the equality, as inequality can lead to social and political tensions and eventually the reversal of trade policy reforms, secondly, increases in poverty and inequality might cause lower economic growth (Aghion et al., 1999, Azaridis et at., 2005).

The evolution of income inequality due to the process of economic development has been dominated by the Kuznets hypothesis. The Kuznet's hypothesis claims that faster GDP growth facilitates reduction of economic inequality in liberalised economies in the long-run. This hypothesis is popularly known as an "inverted U-shaped pattern of income inequality", the inequality first increasing and then decreasing with development. On the other hand, the Hechscher-Ohlin-Samuelson theorem (H-O-S) posits that as less developed countries liberalise their economies, they tend to specialise in the production of goods for which they hold a comparative advantage, namely low skilled labour intensive goods. Consequently, the wages of low skilled workers relative to that of high skilled workers tend to rise due to trade liberalisation. By using the skilled-unskilled wage ratio as a proxy for inequality, therefore, it is expected that inequality should decline in less developed countries in the long run.

To investigate these links economists have employed different theoretical and empirical methodologies such as cross-country or single country case studies, which may also have their own limitations. These limitations point to the need for undertaking in-depth analyses within individual countries over time (Athukorala et al., 2009). Apart from the fact that many different empirical approaches have been used to analyse the impact of trade liberalisation on household income distribution and poverty, Computable General Equilibrium (CGE) modelling is by far the most recognised analytical tool to address the policy issues (Bandara, 1991). This is because these models are able to incorporate various channels through which trade reforms affect different groups in society.

CGE models are generally based on neoclassical theories where households, firms and the other economic agents behave optimally to achieve equilibrium in the economy. For instance, the models can be built as single country or multi-country models, based on a geographical focus (global or regional), sectoral focus (single sector/multiple sectors) and can be static (counterfactual analysis) or dynamic (models that allow the determination of a time path by which a new equilibrium is reached). Models can also be built according to the level of household disaggregation required for analysis.

Filho and Horridge (2004) and Savard (2005) provide useful applications and discussions on income distribution and poverty within a CGE modelling framework. Applications of CGE models in poverty analysis can be classified into three main categories, depending on how households are integrated into the CGE model (Sothea, 2009). They are; the standard Representative Household (RH) approach, the Extended Representative Household approach (ERH), and the Micro-Simulation (MS) approach.

CGE models with RH approach are designed by disaggregating the household sector into several groups assuming that a representative agent from a particular group will constitute the behaviour of the whole group (Naranpanawa, 2005). Accordingly, in the RH approach, poverty analysis is undertaken by using the fluctuations in expenditure or income levels of the RH, which are generated by the model in conjunction with the household survey data. Sothea (2009) pointed out that the RH approach is a traditional method and easy to implement. However, the main limitation of this model for income distribution and poverty analysis is that there are no intra-group income distribution changes because of the single-representative household aggregation.

According to the ERH approach, distributive impacts are easily captured by extending the disaggregation of the representative households in order to identify as many household categories as possible corresponding to different socio-economic groups. In this method, the data that have been directly drawn from a household survey can be used to represent the size distribution of economic welfare, which is consistent with the micro-simulation approach. The main advantage of using this approach is that it provides information on inter-group income distributions (Ravallion et al., 2004 and Bourguignon et al., 2003). Therefore, this method is better able to capture absolute poverty impacts in comparison to the first approach.

For the past 20 years, MS models have been increasingly applied in qualitative and quantitative analyses of economic policies. Bourguignon and Spadaro (2006) point out that the MS technique is useful in analysing economic policies in two ways. Firstly this method fully takes into account the heterogeneity of the economic behaviour agents (e.g. households) observed in micro data unlike RH or ERH methods which only work with typical households (actual/real households) or typical economic agents. Dixon et al. (1995) and Meagher (1996) incorporated a MS model with a partial equilibrium framework in the 1980s and others have subsequently attempted to use MS models by fully integrating households into a CGE model (Cogneau et al., 2001; Decaluwé et al., 1999; Cockburn, 2001; Savard, 2004; Bourguignon and Spadaro, 2006).

Naranpanawa (2005) formulated a poverty focused CGE model for the Sri Lankan economy to investigate link between globalisation and poverty. In order to estimate both intra group income distribution and inter group income distribution, income distribution functional forms for different household groups have been empirically estimated and linked to the CGE model in 'top down' approach. The results revealed that in the short-run, liberalisation of manufacturing industries promote economic growth and reduce absolute poverty in low-income household groups in Sri Lanka. In addition, it was noted that in the long-run, trade liberalisation reduces absolute poverty in substantial proportion in all groups. It further indicates that, in the long-run, liberalisation of the manufacturing industries is more pro poor than that of the agricultural industries. Therefore, the overall simulation results suggest that trade reforms may widen the income distribution gap between the rich and the poor, thus promoting relative poverty.

The majority of multi-country CGE models have used well known databases and modelling software for developing global multilateral general equilibrium trade models through the GTAP. However, the GTAP database is limited to one representative household and therefore its use for poverty impact analysis is crucially dependent on the quality of the database extension for such analysis (Evans, 2001). Gilbert and Oladi (2010) formulated a CGE model to assess the potential impact of trade reforms under the Doha Development Agenda on the economies of South Asia, and compared the results with a potential regional trade agreement (SAFTA). The structure of the model they built is similar in many respects to the GTAP model. The results

suggest that the distributional impacts of trade reforms in South Asia are not likely to be biased against the rural poor in many of the economies.

In this paper, the focus is on a multi country framework rather than single country as has been used widely by many other CGE modellers (e.g. Naranpanawa, 2005, Sothea, 2009) to address the impact of trade reforms on household income distribution and poverty. This is because these types of models offer a complete structure in which to simulate the general impact of trade liberalisation on a national economy in both the short run and long run perspectives. These models are also more suitable for analysing the impacts of multilateral trade liberalisation, or the formation of custom unions etc., on a particular country as the model can link major trading partners with the rest of the world (Naranpanawa, 2005). Hence, multi-country models are able to provide a more realistic assessment of the impacts of trade liberalisation than single country models. Therefore, a multi-country CGE model for South Asia (SAMGEM) is formulated, based on the GTAP model and by disaggregating the household sector in the South Asian economies; hence, the model follows the Extended Representative Agent (ERA) approach in poverty analysis. The model is also formulated by endogenising the monetary poverty line, based on cost of basic needs approach[5], to capture the poverty impacts of trade reforms in South Asia. A non-parametric representative household agent approach is used to estimate the income inequality and poverty effects of trade liberalisation in South Asia on households in Sri Lanka by using the micro household survey data in the DAD (Distributive Analysis) programme.

3. Methodology

3.1 Data

Data used in this paper are drawn primarily from the Consumer Finances and Socio Economic Survey (CFS) in 2003/2004 (The Central Bank of Sri Lanka, 2003/2004) which was conducted by the Central Bank of Sri Lanka. The CFS 2003/2004 covered a sample of 11,722 households representing all districts, provinces and sectors (urban, rural and estate) in the

[5] Decaluwé et at. (1999), Decaluwé, Savard and Thorbecke (2005) and Naranpanawa (2005)

country excluding only Killinochchi, Mannar and Mullaitivu districts in the Northern Province[6]. The sample population totaled 50,545 individuals comprising 26,503 females and 24,042 males in the 11,722 households.

The CFS contains information on income and consumption at a household level. Cockburn (2005) noted that household consumption data are preferred to household income for distributive analysis as it tends to be more stable and reliable. Hence, household consumption data were converted into per capita level by taking into account the household size in conducting the poverty and income distribution analysis which will be discussed in Section 4.

Table 2 Allocation of Sample Proportionate to Housing Units in Population Frame

Province	Population of Household		Sample of Households		Sample Allocation by Sector		
	No.	Percentage	No.	Percentage	Urban	Rural	Estate
Western	1,289,446	27.5	3,224	27.4	856	2,344	24
Central	612,368	13.1	1,536	13.1	120	1,104	312
North Western	603,840	12.9	1,512	12.6	56	1,448	8
Southern	599,765	12.8	1,512	12.8	104	1,376	32
Sabaragamuwa	485,237	10.4	1,216	10.3	40	1,064	112
Eastern	339,341	7.2	856	7.3	168	688	0
Uva	310,139	6.6	784	6.7	32	640	112
North Central	304,569	6.5	768	6.5	32	736	0
Northern	142,452	3.0	360	3.1	80	280	0
Total	1,687,157	100.00	11,768	100.00	1,488	9,680	600
Source: Central Bank of Sri Lanka, 2003/2004							

Table 2 indicates the coverage of the sample size and the surveyed population. The highest number of households (82.26 percent) was from rural areas whilst the lowest sample size and the surveyed population were from the estate sector (5.09 percent). On the other hand the urban sector covers only 12.65 percent of the sample size and the surveyed population. The sample size was designed according to the total population in respective sectors in Sri Lanka.

In conducting income distribution and poverty analysis, the households in Table 2 in urban, rural and estate sectors were divided into 10 groups based on the monthly per capita expenditure. Table 3 indicates the monthly per capita household expenditure by expenditure decile and by sector.

[6] These three districts in the Northern Province were excluded due to the prevailing security situation at that time.

The CFS in 2003/2004 reports that the per capita expenditure per one month in the urban, rural and estate sectors were Rs. 6,383, Rs.3,651 and Rs. 2,367 respectively or in terms of US dollars: US$ 65, US$ 37 and US$ 24 at 2004 exchange rate respectively. However, Sri Lanka used several poverty lines based on different survey data, until her acceptance of the poverty line established for Sri Lanka in June 2004. This was based on the year 2002 Household Income and Expenditure Survey (HIES) data by the Department of Census and Statistics (DCS). The Official Poverty Line (OPL) is an absolute poverty line which is fixed at a specific welfare level in order to compare over time with household food and non-food consumption expenditure. The cost of basic needs approach was used to the value of the OPL (DSC, Sri Lanka, 2006). Accordingly, for the year 2002, the value of the OPL in Sri Lanka was Rs. 1,423 per person per month (just under US$ 15 at 2002 exchange rate), based on the spending needed to obtain minimum basic needs. The DCS updated this value using Colombo Consumer Price Index (CCPI) and the value of OPL for 2006/07 was reported to the Rs. 2,233 (under US$ 22 at 2007 exchange rate).

Table 3 Average Monthly Household Expenditure, by Monthly Per capita Expenditure Deciles – 2003/04

Decile Group	Urban		Rural		Estate	
	Per capital household expenditure Range (Rs.)	Mean Household expenditure (Rs.)	Per capital household expenditure Range (Rs.)	Mean Household expenditure (Rs.)	Per capital household expenditure Range (Rs.)	Mean Household expenditure (Rs.)
All Groups		**6383.35**	**3650.71**		**2367.05**	
1	Less than 1960	1517.56	Less than 1400	1040.43	Less than 1250	1013.90
2	1961-2550	2249.34	1401-1780	1611.87	1251-1475	1382.67
3	2551-3130	2841.10	1781-2110	1945.04	1476-1650	1573.62
4	3131-3850	3507.59	2111-2448	2278.51	1651-1835	1741.74
5	3851-4640	4236.78	2448-2830	2634.16	1836-2065	1937.95
6	4641-5650	5162.20	2831-3300	3059.68	2066-2300	2175.86
7	5651-7030	6256.70	3301-3910	3593.80	2301-2684	2488.48
8	7031-9460	8114.71	3911-4875	4351.82	2685-3173	2903.78
9	9461-14600	11329.87	4876-9600	5704.90	3174-4120	3598.02
10	More than 14660	25728.37	More than 9600	12960.10	More than 4120	6347.30
Source: Author's calculations from the CFS, 2003/2004						

Furthermore, from the aforesaid monthly per capita expenditure reported in the 2003/2004 CFS for urban, rural and estate sectors, the cost of living in urban areas are comparatively higher than that of rural and estate sectors. Therefore, it is more realistic to use different poverty lines for urban, rural and estate sectors in calculating poverty indices as cost of basic needs can be different in different geographical areas in the country.

Gunetilleke and Senanayake (2004) estimated the poverty line for Sri Lanka for the year 2004, using the CCPI on the 2002 poverty line, as Rs. 1526 per month (approximately US$ 16 at 2004 exchange rates). Hence, in calculating national poverty indices, Rs. 1526 will be taken as the national poverty line. Furthermore, DSC estimated different poverty lines for various districts in Sri Lanka in the HIES in 2002. For the present study these values have been updated by using CCPI for determining poverty lines for urban, rural and estate sectors in Sri Lanka. Accordingly for the year 2004, the poverty line[7] for urban sector is estimated as Rs. 1767 (approximately US$ 18 at 2004 exchange rate), for rural sector Rs. 1652 (approximately US$ 17 at 2004 exchange rate) and for the estate sector as Rs.1570 (approximately US$ 16 at 2004 exchange rate).

3.2 Incorporation of the CGE Model Results in Income Distribution and Poverty Analysis

The SAMGEM has been formulated by incorporating the multi-household framework. Therefore, the model can capture the impact of trade liberalisation on the consumer price index for each household group included in the model (see Table A.1 in Appendix). Changes in consumer price index for different household groups in the urban, rural and estate sectors under the SAFTA and unilateral trade liberalisation have been used to generate the new per capita expenditure. Then the base year and the post simulation per capita expenditure will be used to perform poverty and income distribution analysis in DAD. Further, SAMGEM has been formulated by endogenising poverty lines into the model by selecting a basic commodity bundles[8] for urban, rural and estate sector households in Sri Lanka. Hence, changes in these poverty lines will be applied to calculate the poverty indices for urban, rural and estate sectors as a result of implementing the selected trade policy options.

[7] These amounts present the minimum expenditure that a person needs to spend to satisfy basic needs during a one month.

[8] As recommended by Ravallion and Sen (1996) these commodity bundles include the necessities of the respective sectors to satisfy their basic requirements.

4. The Non-parametric or Kernel Method of Income Distribution

As the data on individual income and per capita household consumption levels for Sri Lankan households are available, one can estimate the income distribution by specifying a parametric functional form such as a lognormal or beta distribution. A disadvantage of the parametric method is the need to assume that actual income density needs to be lognormal or other such functions (e.g. beta distribution), which may not always be true (Dhongde, 2004). For instance, Minhas et al. (1987) applied lognormal distribution to analyse income distribution in India, however, Kakwani and Subbarao (1990) mentioned that this lognormal distribution tends to overcorrect the positive skewness of the income distribution and, thus, fits poorly to the actual data. Hence, the non-parametric approach instead estimates distribution directly from the given data, without assuming any particular form. Boccanfuso and Savard (2001) also noted that the parametric approach is particularly useful when the primary household or individual level data are unavailable. The present study employs the non-parametric method or Kernel method as the individual household data are available and therefore, this data can be used directly for poverty and income distribution analysis without assuming any particular functional form for the true distribution.

The Kernel method is the most mathematically studied and commonly used non-parametric density estimation method (Boccanfuso and Savard, 2001). These authors mentioned that the Kernel function (K) is generally a unimodal, symmetric, bounded density function. The Rosenblatt-Parzen Kernel method of nonparametric probability density estimation $\hat{f}(x)$ is given by (Parzen, 1962; Rosenblatt, 1956):

$$\hat{f}(x) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{h}K\left(\frac{x - x_i}{h}\right)$$

In the Kernel density function h is the smoothing parameter and N is the sample size. When using this estimator, each observation will provide a 'bump' to the density estimation of $\hat{f}(x)$, consequently the shape and the width of the density function depends on the shape of K and the size of h respectively. Once all these 'bumps' are summed the distribution of all data points will be obtained. In this case K and h affect the accuracy of the density function,

essentially the smoothing parameter (h), which means, the smaller the value of h, the less smooth will be the density estimates whereas, the larger the value of h, the estimated density function will be too smooth. The poverty head count ratio is obtained by summing all the estimated densities, until the poverty line income is reached. In performing non-parametric method or Kernel estimation, DAD software will be used. DAD[9] which stands for 'Distributive Analysis/Analyse Distributive' is specially designed to facilitate the analysis and the comparisons of social welfare, inequality and poverty using micro data.

4.1 Poverty and Inequality Measures

It is important to note that although there is some relationship between poverty and income inequality, they are two different concepts (Borraz et al., 2012). Armstrong et at., (2009) explained that poverty measures fall under two broad categories: absolute poverty, which measures the number of people below a certain income threshold, that is unable to afford certain basic goods and services, and relative poverty that compares household income and spending patterns of groups or individuals with the income and expenditure patterns of the population.

On the other hand, Haughton and Khandker (2009) describes that inequality is a broader concept than poverty and it is defined over the entire population and does not only focus on the poor. Inequality measurements generally sort the population from poorest to richest and exhibit the percentage of expenditure (or income) attributable to each fifth (quintile) or tenth (decile) of the population. In the literature there are various measures of poverty and income inequality such as Sen Index (Sen, 1976), Watts Index (Zheng, 1993), S-Gini coefficient (Kakwani, 1980), Theil Index (Champernowne, 1974) and Atkinson Index (1970). The present study uses the measurements described in the following section to analyse the impact of trade liberalisation on household income distribution and poverty in the Sri Lankan economy.

[9] DAD or Distributive Analysis/Analyse Distributive software (Duclos, Araar and Fortin, 2002) was specifically developed to undertake poverty and income distribution analysis. It is freely distributed and available at www.mimap.ecn.ulaval.ca

4.1.1 Poverty Measures

The present study employs the Foster, Greer and Thorbecke (FGT) indices to evaluate poverty for a base year and after simulation for each household group with an endogenous poverty line in the SAMGEM. The FGT index renders the properties such as monotonicity, flexibility and distributional sensitivity axiom and therefore, it is by far the most frequently used poverty index (Foster, Greer and Thorbecke, 1984). In addition to the aforesaid characteristics, the FGT measure can also be applied to various sub-groups in a given population. Accordingly, this attribute will be applied in Section 7.5 to estimate poverty across various sub-groups of urban, rural and estate sectors in Sri Lanka.

Cockburn (2005, p.2) explains the FGT index as follows:

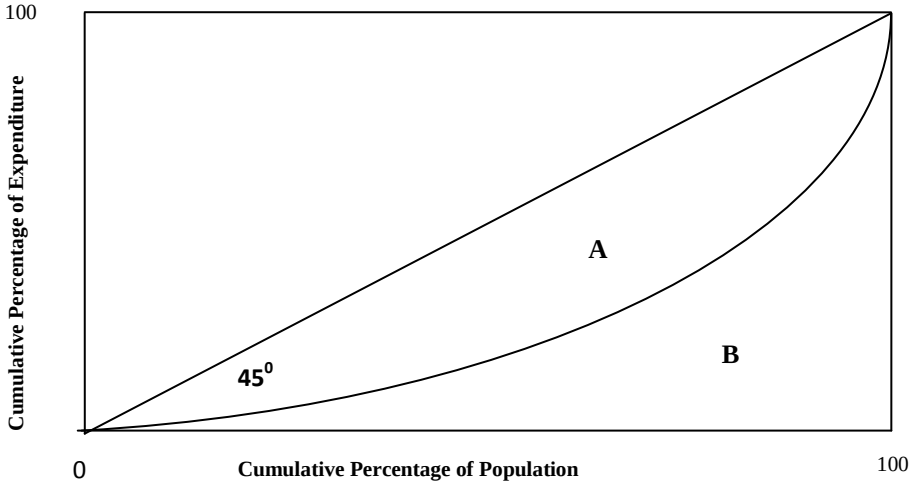
$$P_{\alpha} = \frac{1}{Nz^{\alpha}} \sum_{j=1}^{J} \left[z - y_j \right]^{\alpha}$$

In the above formula, j is the sub-group of individuals with income below the poverty line (z). N is the total number of individuals in the sample, y_j is the income of individual j and α is the parameter which allows the analysis to distinguish between alternative FGT indices. Therefore, by allowing the poverty parameter α to vary, it makes it possible to investigate different aspects of poverty. As explained by Cockburn (2005), when α is equal to 0 the above expression simplifies to $\frac{J}{N}$ and this measures the poverty head count ratio, which indicates the incidence of poverty. Similarly, poverty depth is measured by poverty gap, which can be obtained when α is equal to one and the poverty severity is measured by setting α is equal to two.

4.1.2 Inequality Measurements

While FGT indices are used to measure poverty, Lorenz curve and S-Gini index are widely and commonly used measures of income inequality. With households in rising order of income, the Lorenz curve expresses the cumulative percentage of population on the x-axis (the p-values) and the cumulative percentage of income or expenditure on the y-axis (Cockburn,2005). Figure 2 below illustrates the graphical representation of a typical Lorenz curve.

Figure 2 Lorenz Curve



As shown in the figure, the curvature of the Lorenz curve summarizes inequality: if everyone had the same income/expenditure (the perfect equality case), the Lorenz curve would lie along a 45^0 ray from the origin and, if all income/expenditure were held by just one person (complete inequality), and the curve would lie along the horizontal axis.

The Gini coefficient is a measure of income inequality which provides a compact version of the Lorenz curve (Kakwani, 1980, Kakwani, 1986, Villasenor and Arnold, 1989, Basmann et al., 1990, Ryu and Slottje, 1996). This can be calculated as the ratio of area enclosed by the Lorenz curve and the perfect equality line to the total area below that line, which means that the Gini coefficient is defined as A/(A + B), where A and B are the areas shown in Figure 2. If A is equal to 0, the Gini coefficient becomes 0, which means perfect equality, whereas if B is equal to 0, the Gini coefficient becomes 1, which means complete inequality. Haughton and Khandker (2009) consider that inequality may be broken down by population groups or income sources or in other dimensions. However, they mentioned that the Gini index is not easily decomposable or additive across groups and therefore, the total Gini of the society is not equal to the sum of the Gini coefficients of its sub groups.

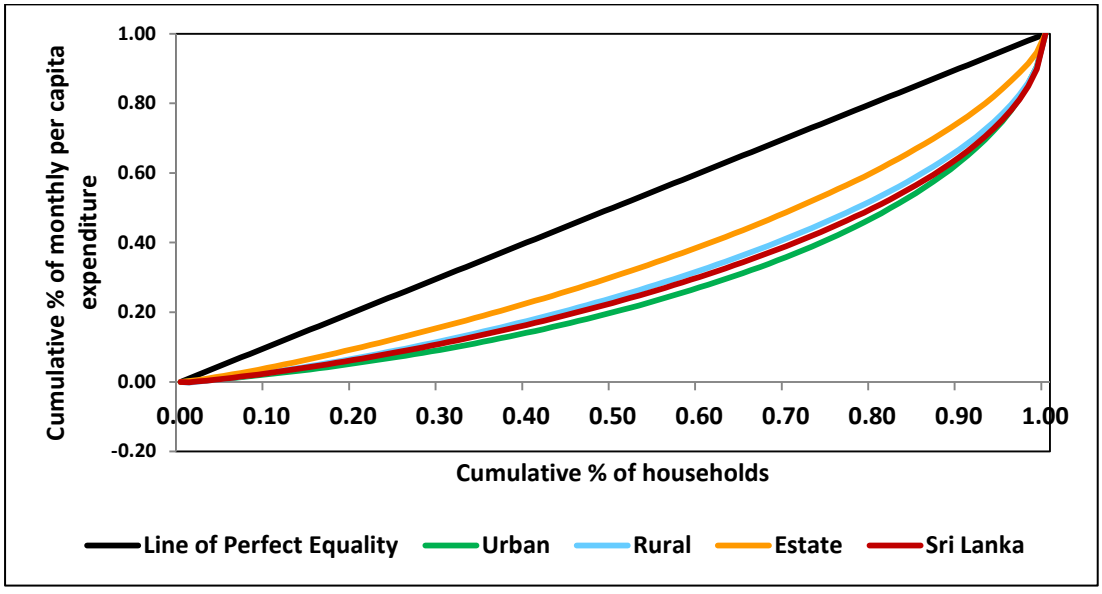
5. Discussion of Results

5.1 Income Inequality in Sri Lanka

As previously noted, the Lorenz curve and the Gini coefficient are the most commonly used indicators of inequality. Hence, the present study will estimate Lorenz curves for Sri Lanka at national level as well as for different sectors (urban, rural and estate) by using the household survey data of CFS 2003/04. Moreover, S-Gini coefficients will also be calculated for different sectors and different household groups, so that it will enable to decide the extent to which trade liberalisation helps to reduce inequality between different groups in such sectors.

Figure 3 illustrates the estimated Lorenz curves for Sri Lanka at national level as well as for different sectors based on the monthly per capita expenditure obtained from the CFS, 2003/04.

Figure 3 Lorenz Curves for Sri Lanka



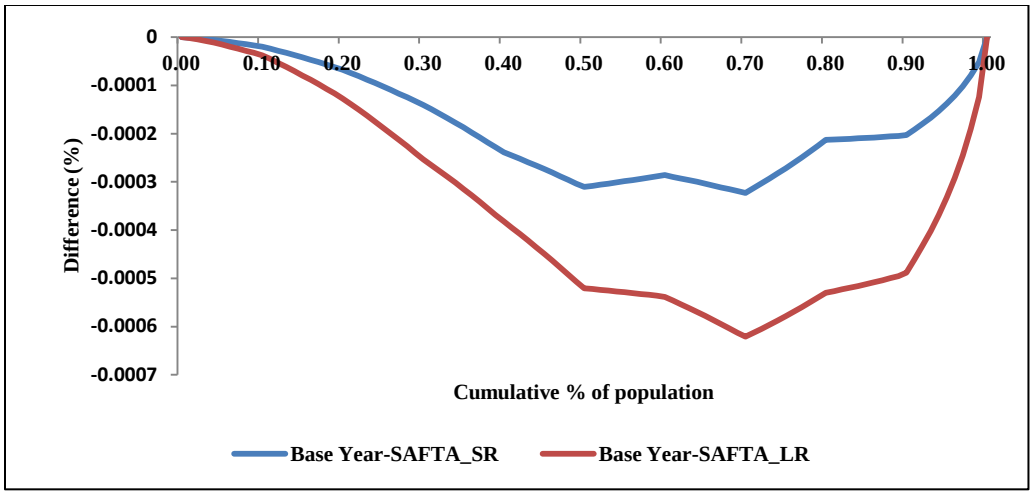
Source: Author's estimation from the CFS 2003/04

A comparison of the sectoral Lorenz curves for the base year shows that the urban sector Lorenz curves dominates the rural sector, which in turn dominates the estate sector

Lorenz curve. Hence, it is clear that the inequality is the lowest in the estate sector and the highest in the urban sector with the rural sector occupying a position in between.

Given these base year scenarios, it is interesting to determine whether SAFTA and unilateral trade liberalisation would reduce inequality in different sectors in Sri Lanka. Under these trade policy options, it appears that only very slight movement occurs in the Lorenz curve in all three sectors, so that there is no wider gap between Lorenz curves for two income distributions, i.e. between base year and after liberalisation. Araar and Duclos (2006) explained that when the gap between two Lorenz curves is marginal, it is appropriate to estimate the difference between two Lorenz curves. Hence, Figures 4 and 5 present such a plot for differences (i.e. the difference between base year and after trade liberalisation) in Lorenz curves under the SAFTA and unilateral trade liberalisation in the short run and long run in the urban sector. In estimating the difference between Lorenz curves, a new vector containing post liberalisation per capita expenditure for each household were obtained by applying the price changes generated by the SAMGEM under the policy options analysed.

Figure 4 Difference between the Lorenz Curves in Urban Sector: SAFTA and Base Year

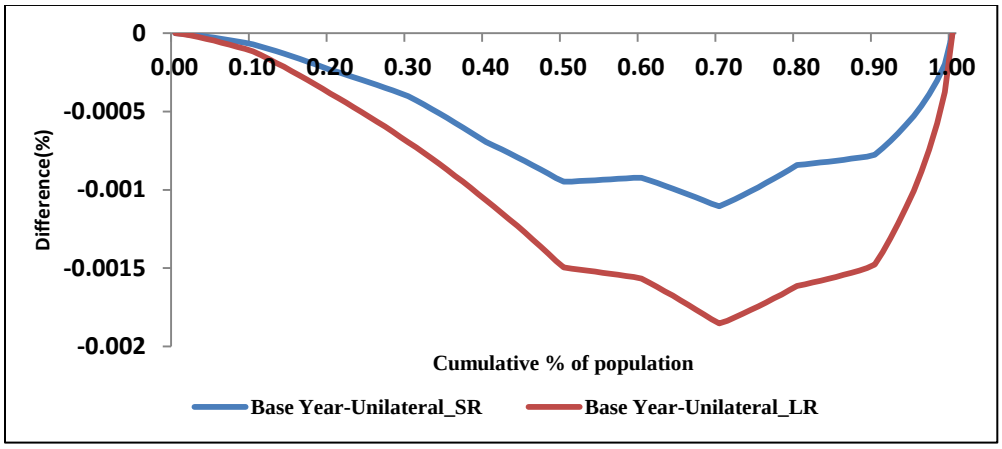


Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

The vertical axis of the graph depicts the difference between base year and post trade liberalisation income distributions and the horizontal axis represents the household deciles. It is noted that the curves under the SAFTA and unilateral trade liberalisation both in the short run

and long run show a U shape, indicating that there is a reduction in inequality, however, the reduction is higher in the long-run in comparison to the short-run under both policy options. Moreover, the reduction of inequality is more pronounced under the unilateral trade liberalisation than under the SAFTA.

Figure 5 Differences between the Lorenz Curves in Urban Sector: Unilateral Trade Liberalisation and Base Year

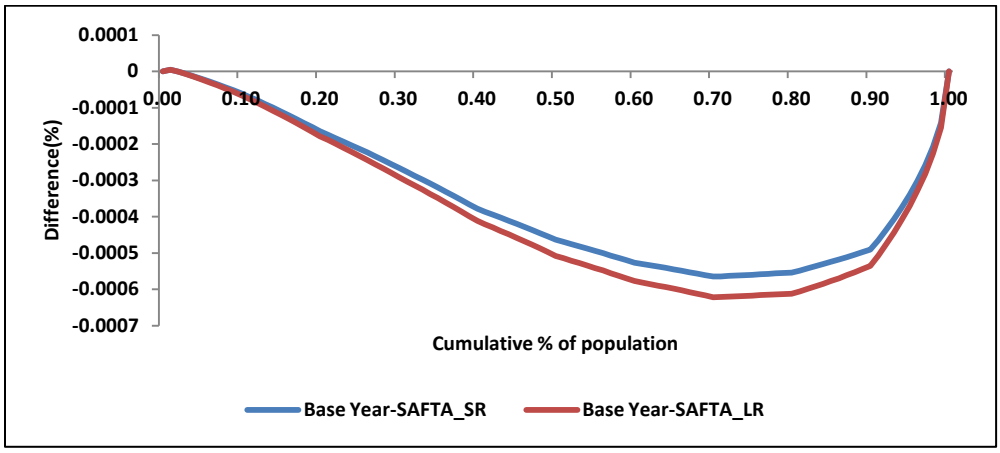


Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

It is also apparent that the extent of redistribution of income is largest in the middle income group compared with the lowest and the highest income groups. For instance, transition from base scenario to SAFTA at the fifth decile, there is a redistribution of 0.03 percent and 0.05 percent of total income in the short-run and long-run respectively from the rich to poor households. Under the unilateral trade liberalisation, it is apparent that at the fifth decile the inequality will further reduce from 0.10 percent in the short-run to 0.15percent in the long-run. This will further reduce at the seventh decile where reduction of inequality 0.12 percent and 0.18 percent in short run and long run respectively.

Figures 6 and 7 illustrate the difference between Lorenz curves of the two trade policies by comparing with the base scenario in the rural sector.

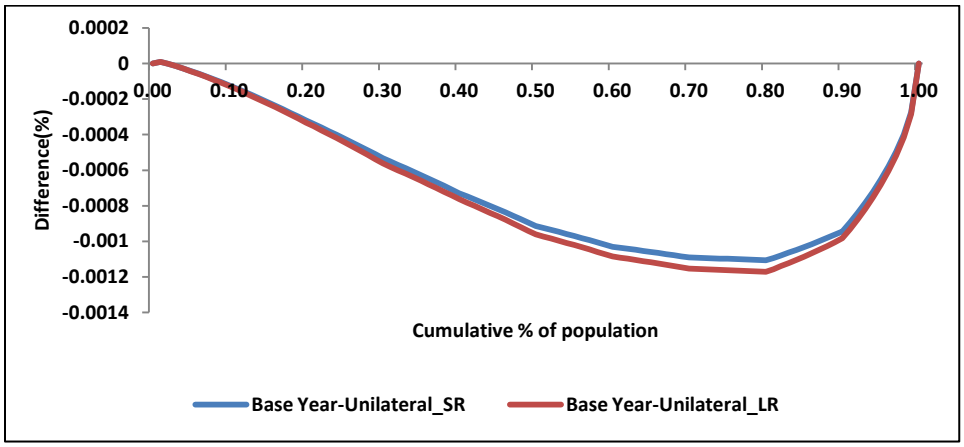
Figure 6 Difference between the Lorenz Curves in Rural Sector: SAFTA and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

The difference between Lorenz curves for two income distributions, under the SAFTA and unilateral trade liberalisation in the rural sector is also reveal a U shape both in the short and long run. Hence, it is apparent that inequality in the rural sector will also reduce under both policy options. Although under the unilateral trade liberalisation the reduction in income inequality is higher than that of SAFTA, there is no wider gap between the short-run and the long-run. It is also clear that the reduction in income inequality is higher in the middle income groups than that of lowest and the highest income groups. Consequently, in the rural sector also there is a redistribution of income from the richer household groups to the middle income household groups due to trade liberalisation.

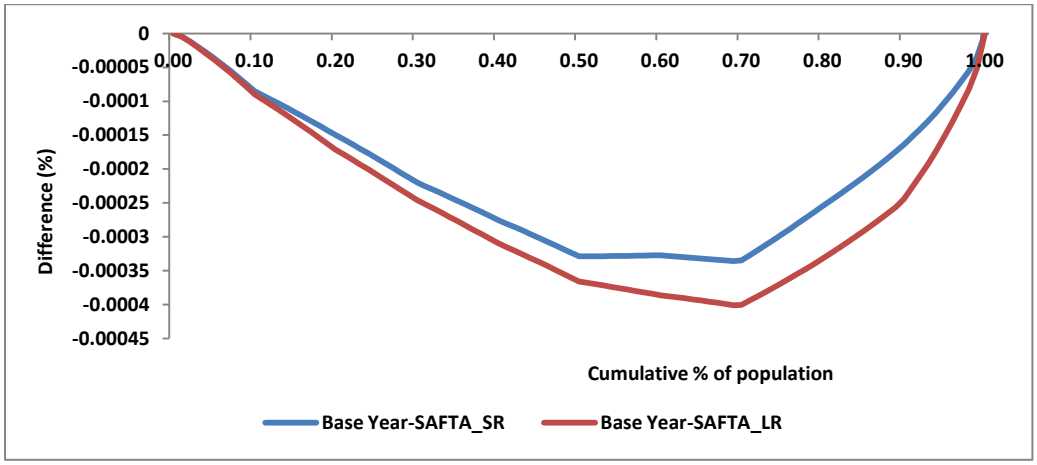
Figure 7 Differences between the Lorenz Curves in Rural Sector: Unilateral Trade Liberalisation and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

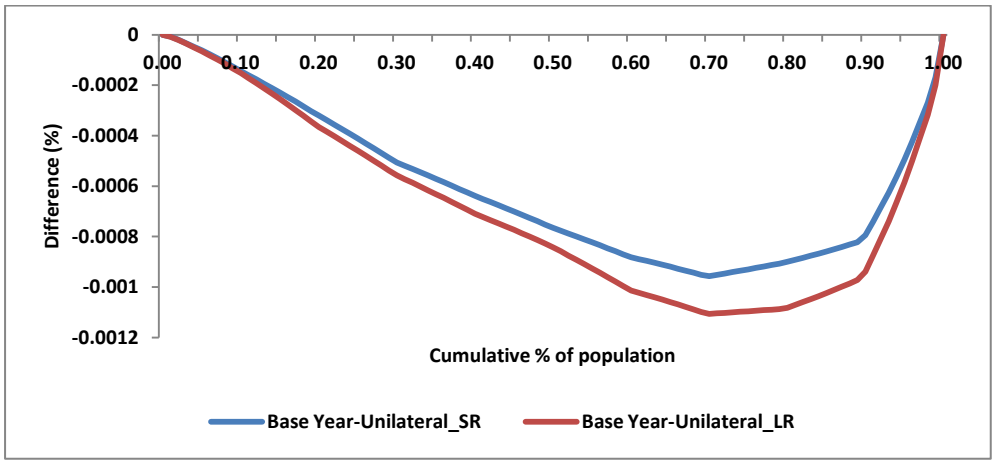
Figures 8 and 9 illustrate the difference between Lorenz curves under SAFTA and unilateral trade liberalisation in the estate sector in short-run and long-run.

Figure 8 Difference between the Lorenz Curves in Estate Sector: SAFTA and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Figure 9 Difference between the Lorenz Curves in Estate Sector: Unilateral Trade Liberalisation and Base Year



Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

The above figures indicate that, similar to the urban and rural sectors, there is a notable reduction in income inequality in the estate sector middle income household groups under both policy options. In the case of unilateral trade liberalisation, it appears that the reduction in income inequality is higher than that of SAFTA. There is a redistribution of income from rich to poor households under both the policy options.

The Lorenz curve provides useful ways of showing the complete pattern of income distribution. However, the S-Gini index is the most commonly applied inequality measure in the literature, probably because of its link to the Lorenz curves which provide an intuitive and graphical representation of inequality (Ourti and Clarke, 2008). Table 4 illustrates the Gini coefficients for Sri Lanka at national level during different survey periods based on the monthly per capita expenditure.

Table 4 Gini-Coefficient of Household Expenditure for Sri Lanka

	Survey Period				
	2002	**2003/04***	**2005**	**2006/07**	**2009/10**
Gini coefficient of household expenditure at national level	0.41	0.43	0.40	0.41	0.37

Source: Household Income and Expenditure Survey Reports, Various Issues, Department of Census and Statistics, Sri Lanka.

* Author's estimation from the CFS 2003/04

According to Table 4, the Gini index at national level in 2002 was 0.41 and the estimated results demonstrate that this increased to 0.43 in 2003/04. The Gini coefficient of Sri Lanka has increased at an annual rate of 4.87 percent in 2003/2004. The reason for the rise in inequality in these periods was due to the Asian tsunami which brought huge economic losses and increased the vulnerability of coastal communities in Sri Lanka. Furthermore, political unrest and civil war which prevailed in Sri Lanka for more than two decades hindered the country's development process and disrupted the normalcy of the growth process. Hence, these factors also adversely affected to different socio economic -groups in Sri Lanka, thereby raising inequality. However, it is apparent that by 2009/10 inequality drops by 10.8 percent compared to 2006/07 as a result of improved political and economic stability in the country.

On the other hand, it is apparent that, per capita consumption between sectors (urban, rural and estate) was uneven according to the household expenditure data of CFS, 2003/04 (see Table 3). Hence, it is interesting to determine the inequality in different sectors in Sri Lanka before and after trade liberalisation. The DAD programme provides the facility to decompose the S-Gini index by different household groups. Hence, the S-Gini index has been calculated to illustrate the extent of inequality between different household groups. This is particularly useful to demonstrate how trade policies may alter the income distribution of richer households and

poorer households in different sectors in Sri Lanka. Tables 5-7 present the S-Gini coefficients for urban, rural and estate sectors in Sri Lanka under the base year, SAFTA and unilateral trade liberalisation.

Tables 5-7 indicate that the estimated S-Gini coefficient of household per capital expenditure for urban, rural and estate sectors are 0.4659, 0.4040 and 0.2991 respectively. This means that the income disparity between households is highest in the urban sector and the lowest in the estate sector in the base year, which indicates that there was a greater homogeneous consumption pattern among the households in the estate sector than the other two sectors.

In the urban sector, 5.24 percent of the total consumption expenditure is spent by those of the poorest two deciles, while 52.95 percent of the total expenditure is spent by those in the richest two deciles in the base year. At the rural level, the corresponding figures are 6.72 percent and 47.72 respectively. On the other hand in the estate sector poorest two deciles spend 9.46 percent whereas the richest two deciles spent 40.25 percent of the total expenditure in the base year. This further explains that the inequality is higher in the urban sector in comparison to the other two sectors in Sri Lanka.

When examining the post liberalisation inequality under the SAFTA, it is apparent that in the urban sector inequality will decrease overall in the short-run (0.4655) and this further reduces in the long-run (0.4652). Table 5 illustrates the estimated S-Gini coefficients as 0.4646 and 0.4638 respectively under the unilateral trade liberalisation, which indicates that inequality further reduces in the urban sector in the long-run. Moreover, it is apparent that in the urban sector the share of the expenditure that the poorest two deciles will be able to spend increases up to 5.26 percent and in the richest two deciles reduces to 52.46 percent in the long-run under the SAFTA. Additionally, under the unilateral trade liberalisation the share of total expenditure being spent by the poorest two deciles increases up to 5.28 percent and the same in the richest two deciles reduces up to 52.79 percent in comparison to the base year. This indicates that there is a redistribution of income from the rich to the poor households in the long-run due to trade liberalisation in the urban sector.

Table 5 Decomposition of inequality by group using the S-Gini Index: Urban Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
		Expend (%)	S-Gini	Short-Run		Long-Run		Short-Run		Long-Run	
				Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.4659 (0.0134)**	**100**	**0.4655 (0.0135)**	**100**	**0.4652 (0.0134)**	**100**	**0.4646 (0.013)**	**100**	**0.4638 (0.0135)**
Between Groups			**0.4525 (0.0135)**		**0.4522 (0.0137)**		**0.4518 (0.0133)**		**0.4513 (0.0136)**		**0.4505 (0.0134)**
S-Gini by groups											
Decile 1	10	2.12	0.1227 (0.008)	2.13	0.1226 (0.009)	2.13	0.1225 (0.008)	2.13	0.1225 (0.008)	2.14	0.1224 (0.008)
Decile 2	10	3.12	0.0436 (0.001)	3.12	0.0435 (0.002)	3.13	0.0434 (0.001)	3.13	0.0434 (0.002)	3.14	0.0433 (0.0015)
Decile 3	10	3.95	0.0321 (0.001)	3.94	0.0320 (0.002)	3.95	0.0320 (0.001)	3.95	0.0320 (0.001)	3.95	0.0321 (0.0012)
Decile 4	10	4.84	0.0340 (0.001)	4.85	0.0339 (0.001)	4.86	0.0339 (0.003)	4.87	0.0339 (0.001)	4.88	0.0339 (0.0013)
Decile 5	10	5.89	0.0321 (0.001)	5.89	0.0320 (0.001)	5.90	0.0320 (0.001)	5.91	0.0320 (0.001)	5.94	0.0320 (0.0011)
Decile 6	10	7.16	0.0332 (0.001)	7.15	0.0331 (0.001)	7.60	0.0331 (0.001)	7.15	0.0331 (0.001)	7.17	0.0330 (0.0011)
Decile 7	10	8.69	0.0383 (0.004)	8.70	0.0382 (0.002)	8.70	0.0382 (0.001)	8.71	0.0382 (0.001)	8.72	0.0381 (0.0014)
Decile 8	10	11.28	0.0491 (0.002)	11.28	0.0490 (0.002)	11.27	0.0490 (0.002)	11.26	0.0490 (0.001)	11.27	0.0490 (0.0018)
Decile 9	10	15.78	0.0679 (0.003)	15.78	0.0678 (0.003)	15.44	0.0678 (0.003)	15.78	0.0678 (0.002)	15.77	0.0677 (0.0029)
Decile 10	10	37.17	0.2738 (0.032)	37.16	0.2737 (0.033)	37.02	0.2736 (0.032)	37.11	0.2736 (0.032)	37.02	0.2735 (0.0321)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: The respective standard errors are reported in parenthesis at 95% confidence limit Expend- Per capita expenditure

Table 6 Decomposition of inequality by group using the S-Gini Index: Rural Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
		Expend (%)	S-Gini	Short-Run		Long-Run		Short-Run		Long-Run	
				Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.4040 (0.0070)**	**100**	**0.4033 (0.0070)**	**100**	**0.4032 (0.0071)**	**100**	**0.4026 (0.0073)**	**100**	**0.4025 (0.0072)**
Between Groups			**0.3911 (0.0061)**		**0.3904 (0.0062)**		**0.3904 (0.0061)**		**0.3898 (0.0067)**		**0.3897 (0.0066)**
S-Gini by groups											
Decile 1	10	2.60	0.2584 (0.0672)	2.58	0.2583 (0.0672)	2.58	0.2582 (0.0672)	2.58	0.2581 (0.0672)	2.60	0.2580 (0.0673)
Decile 2	10	4.12	0.0363 (0.0005)	4.14	0.0363 (0.0005)	4.15	0.0363 (0.0005)	4.14	0.0362 (0.0056)	4.14	0.0361 (0.0005)
Decile 3	10	4.96	0.0276 (0.0004)	4.98	0.0275 (0.0004)	4.98	0.0275 (0.0004)	4.98	0.0274 (0.0004)	4.99	0.0273 (0.0004)
Decile 4	10	5.81	0.0247 (0.0003)	5.83	0.0246 (0.0003)	5.82	0.0246 (0.0003)	5.84	0.0245 (0.0003)	5.84	0.0244 (0.0003)
Decile 5	10	6.71	0.0245 (0.0003)	6.72	0.0244 (0.0003)	6.73	0.0244 (0.0003)	6.73	0.0243 (0.0003)	6.73	0.0242 (0.0003)
Decile 6	10	7.81	0.0264 (0.0004)	7.82	0.0263 (0.0003)	7.82	0.0263 (0.0004)	7.83	0.0262 (0.0004)	7.83	0.0262 (0.0003)
Decile 7	10	9.17	0.0283 (0.0004)	9.17	0.0283 (0.0004)	9.18	0.0283 (0.0004)	9.18	0.0283 (0.0004)	9.18	0.0282 (0.0004)
Decile 8	10	11.10	0.0365 (0.0005)	11.11	0.0365 (0.0005)	11.10	0.0364 (0.0005)	11.11	0.0363 (0.0005)	11.11	0.0363 (0.0005)
Decile 9	10	14.58	0.0560 (0.0009)	14.57	0.0559 (0.0008)	14.57	0.0558 (0.0008)	14.57	0.0557 (0.0008)	14.56	0.0557 (0.0008)
Decile 10	10	33.14	0.3025 (0.0178)	33.08	0.3026 (0.0178)	33.07	0.3025 (0.0178)	33.04	0.3024 (0.0178)	33.02	0.3024 (0.0178)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: The respective standard errors are reported in parenthesis at 95% confidence limit Expend- Per capita expenditure

The S-Gini coefficient in the rural sector under the SAFTA will also reduce to 0.4033 and 0.4032 in the short-run and long-run respectively. It is also noticed that there is a greater reduction in inequality occur under the unilateral trade liberalisation in which case the estimated S-Gini coefficient in the short-run 0.4026 and in the long-run 0.4025. It is seen that under the SAFTA, the share of expenditure that will be spent by the poorest two deciles increases to 6.73 percent while in the richest two deciles the share reduces to 47.65 percent in the long-run. Under the unilateral trade liberalisation it also appears that there is a redistribution of income from rich to poor household groups in the rural sector as the share of expenditure that the poorest two deciles can spend will increase to 6.74 percent and the same in the richest households reduces to 47.58 percent in the long-run.

The estimated Gini coefficients in the estate sector under the SAFTA shows a slight decrease in the inequality from 0.2986 in the short-run to 0.2985 in the long-run. In the case of unilateral trade liberalisation the estimated Gini coefficients in the short-run (0.2980) and long-run (0.2978) indicate that the income disparity in the estate sector will further narrow in the long-run as a result of trade liberalisation.

When examining the estimated S-Gini coefficients between household groups it is apparent that there is a reduction in inequality between household groups under the two trade policies in all three sectors. Hence, it is clear that income disparities may narrow down between the household groups due to trade liberalisation. As explained before, there is lower inequality between household groups in the estate sector than that of urban and rural sectors in Sri Lanka.

Changes in the S-Gini coefficients under the SAFTA and unilateral trade liberalisation confirm that inequality in urban, rural and estate sectors will reduce especially in the long-run. The standard deviations reported in the parentheses were used to calculate “t” values for respective S-Gini coefficients. These values are reported in Appendix A.5. Since, there are a large number of observations, the critical “t” value when α=0.025 takes 1.95. This has been compared with the calculated “t” values to determine the significance of the above results provided in Tables 5 -7. The “t” test indicated that the calculated S-Gini-coefficients are significant at five percent significance level (95 percent confidence limit).

Table 7 Decomposition of inequality by group using the S-Gini Index: Estate Sector

Group	Population Share (%)	Base Year		SAFTA				Unilateral Trade Liberalisation			
		Expend (%)	S-Gini	Short-Run		Long-Run		Short-Run		Long-Run	
				Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini	Expend (%)	S-Gini
Total	**100**	**100**	**0.2991 (0.0134)**	**100**	**0.2986 (0.0134)**	**100**	**0.2985 (0.0134)**	**100**	**0.2980 (0.0134)**	**100**	**0.2978 (0.0134)**
Between Groups			**0.2915 (0.0135)**		**0.2912 (0.0136)**		**0.2911 (0.0135)**		**0.2905 (0.0136)**		**0.2904 (0.0135)**
S-Gini by groups											
Decile 1	10	4.02	0.1054 (0.0209)	4.03	0.1053 (0.0209)	4.03	0.1052 (0.0209)	4.03	0.1051 (0.0209)	4.03	0.1050 (0.0209)
Decile 2	10	5.44	0.0279 (0.0014)	5.45	0.0279 (0.0014)	5.44	0.0279 (0.0014)	5.43	0.0279 (0.0014)	5.43	0.0279 (0.0014)
Decile 3	10	6.16	0.0188 (0.0011)	6.17	0.0188 (0.0011)	6.17	0.0188 (0.0011)	6.18	0.0188 (0.0011)	6.18	0.0188 (0.0011)
Decile 4	10	6.94	0.0166 (0.0009)	6.94	0.0166 (0.0009)	6.95	0.0166 (0.0009)	6.95	0.0166 (0.0009)	6.96	0.0166 (0.0009)
Decile 5	10	7.60	0.0220 (0.0011)	7.60	0.0220 (0.0011)	7.60	0.0220 (0.0011)	7.61	0.0220 (0.0011)	7.62	0.0220 (0.0011)
Decile 6	10	8.53	0.0188 (0.0011)	8.53	0.0188 (0.0011)	8.53	0.0188 (0.0011)	8.54	0.0188 (0.0011)	8.54	0.0188 (0.0011)
Decile 7	10	9.75	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)	9.76	0.0272 (0.0015)
Decile 8	10	11.31	0.0263 (0.0017)	11.30	0.0263 (0.0017)	11.30	0.0263 (0.0017)	11.31	0.0262 (0.0017)	11.31	0.0262 (0.0017)
Decile 9	10	14.12	0.0399 (0.0027)	14.12	0.0399 (0.0027)	14.12	0.0399 (0.0027)	14.14	0.0398 (0.0027)	14.15	0.0398 (0.0027)
Decile 10	10	26.13	0.1923 (0.0305)	26.10	0.1923 (0.0305)	26.10	0.1923 (0.0305)	26.05	0.1923 (0.0305)	26.02	0.1923 (0.0305)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: The respective standard errors are reported in parenthesis at 95% confidence limit Expend- Per capita expenditure

The estimated Lorenz curves and the Gini coefficients suggest that inequality in households in urban, rural and estates sectors is expected to fall under the SAFTA and unilateral trade liberalisation both in the short run and long run. Hence, it appears that this long term effects of trade liberalisation are consistent with the H-O-S theorem. Furthermore, the U shape difference between Lorenz curves (base year and after trade liberalisation) indicate that there is redistribution of income from rich to poor households under both the trade policy options.

5.2 Non-parametric Estimation of Poverty in Sri Lanka

The aim of the present section is to investigate the impact of trade liberalisation on poverty of different household groups in urban, rural and estate sectors in Sri Lanka. Poverty indicators are estimated for the base year and after liberalisation, namely: under the SAFTA and unilateral trade liberalisation, which determine the extent to which trade liberalisation affect poverty in Sri Lanka.

As mentioned in Section 4.1.1, Foster-Greer-Thorbecke (FGT) index is used to analysis the poverty in urban, rural and estate sectors in Sri Lanka. The poverty head-count ratio ($\alpha=0$), is the most commonly used indicator of poverty as it gives the proportion of population earning income less than or equal to the poverty line income level. In analysing poverty other poverty measures are estimated such as the poverty gap ($\alpha=1$), which measures the extent to which individuals fall below the poverty line and poverty severity ($\alpha=2$) which averages the squares of the poverty gaps relative to the poverty line.

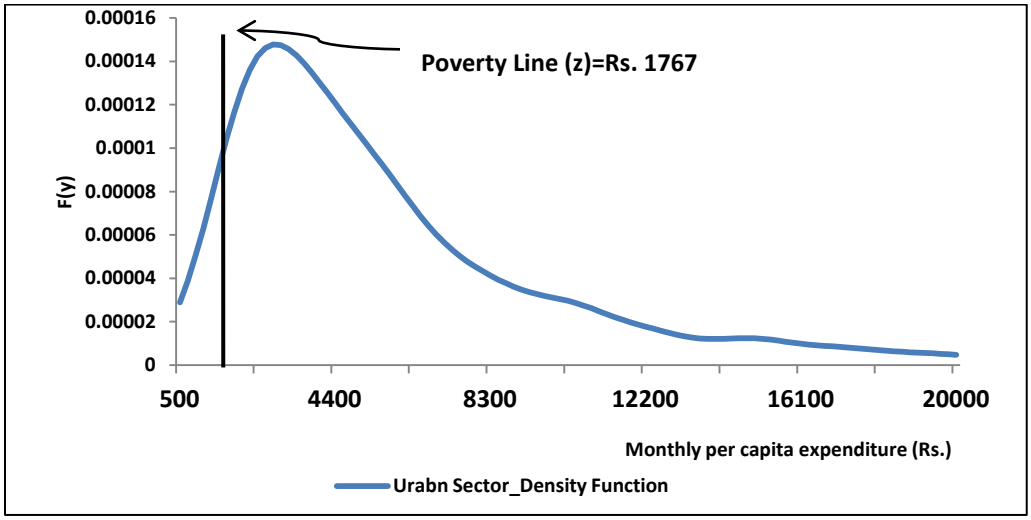
In order to estimate the poverty head count ratio, one needs to estimate the distribution of income (Dhongde, 2004). Hence, the present study estimates the income distribution functions for urban, rural and estate sectors in Sri Lanka by employing the non-parametric technique, as the non-parametric method estimates income distribution directly without assuming any particular functional form for the true distribution.

- **Urban Sector Density Function**

Figures 10-12 illustrate the Kernel Density Function of per capita expenditure for urban, rural and estate sector household groups in Sri Lanka in the base year. The vertical axis presents

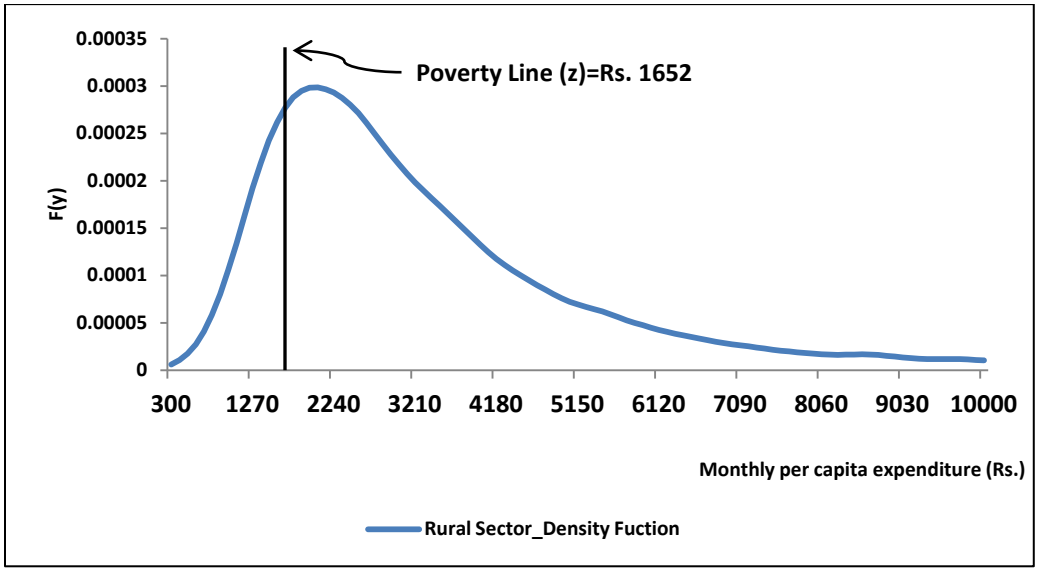
the y value which is an estimate of the probability density at value of x (monthly per capita expenditure). The vertical line is the poverty line in: urban sector Rs. 1767, rural sector Rs. 1652 and estate sector Rs. 1570 in the base year respectively.

Figure 10 Urban Sector Density Function: Base Year 2003/04



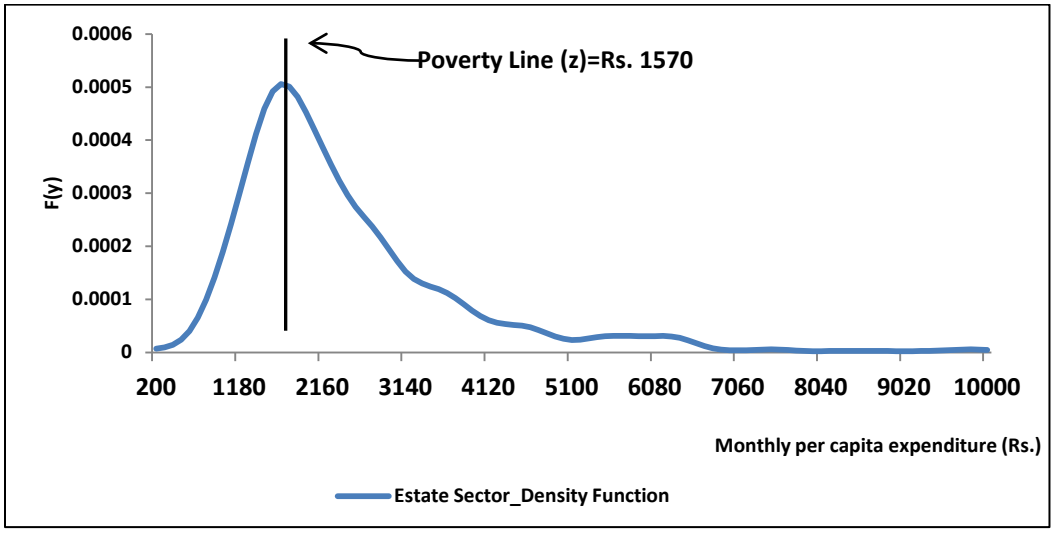
Source: Author's estimation from CFS, 2003/04

Figure 11 Rural Sector Density Function: Base Year 2003/04



Source: Author's estimation from CFS, 2003/04

Figure 12 Estate Sector Density Function: Base Year 2003/04



Source: Author's estimation from CFS, 2003/04

Dhongde (2004) explained that according to the Kernel method, the poverty head count ratio is calculated by taking the sum of the estimated densities until the poverty line of income (per capita expenditure) level is reached. From the above estimated density functions it is clear the urban sector has the smallest proportion of households living below the poverty line and in contrast the highest in the estate sector, while the rural sector records the higher level of poverty than the urban sector and lower than that of the estate sector in the base year. The reasons for poverty differences in urban, rural and estate sector poverty will be discussed in the latter part of this section.

Given the base year scenario, it is interesting to examine the impact of SAFTA and unilateral trade liberalisation on poverty in urban, rural and estate sectors in Sri Lanka. As noted in Section 3.2, SAMGEM has been formulated by incorporating monetary poverty lines for urban, rural and estate sectors in Sri Lanka. These changes in monetary poverty lines will be taken into account in calculating FGT indices for different trade policy scenarios, namely: SAFTA and unilateral trade liberalisation. Table 8 illustrates the percentage changes in average poverty line for urban, rural and estates sectors in Sri Lanka under SAFTA and unilateral trade liberalisation.

Table 8 Percentage Change in Poverty Lines in Different Sectors in Sri Lanka

Sector	SAFTA		Unilateral Trade Liberalisation	
	Short-Run	Long-Run	Short-Run	Long-Run
Urban	-0.3370	-0.5601	-3.3387	-3.4669
Rural	-0.6391	-1.0624	-3.9818	-4.5568
Estate	-0.6903	-1.1150	-4.2033	-4.7778

Source: Simulation Results from SAMGEM

Table 8 shows that the poverty line declines for all three sectors under both trade liberalisation options although the magnitude of the decrease in values are higher in the long-run. Further, it is apparent that there is larger reduction in monetary poverty lines under unilateral trade liberalisation due to non discriminatory trade liberalisation. Additionally, one can observe that reduction in prices of a basic commodity bundle is larger for rural and estate sectors households than the urban sector as the basic commodity bundle mainly includes food items for which the rural and estate sector have a higher demand. As a result of the removal of tariffs under the two trade policy options, the prices of basic goods become cheaper in comparison to manufacturing and industrial goods. The estimated values of per capita expenditure and new prices generated under the trade policy options were used in calculating FGT indices to ascertain the post simulation poverty profiles in urban, rural and estate sectors in Sri Lanka.

In order to understand how poverty profiles change in urban, rural and estate sectors as a result of implementing the two trade policies, it is useful to estimate the density functions incorporating post simulation results with new per capita income and new poverty line. The Density function for per capita expenditure illustrates the percentage of individuals with a given per capita expenditure. However, the estimated post liberalisation density functions overlap the above illustrated density functions demonstrated from Figures 10 -12 since simulated post shock values are comparatively smaller. Hence, under such circumstances, Araar and Duclos (2006) suggest that it is appropriate to estimate difference between two density functions, namely; difference between base year values and post simulation values.

Appendix A.2 to A.4 explain the difference between density functions (i.e. the difference between the base year values and the post simulation values) under the SAFTA and unilateral trade liberalisation for urban, rural and estate sectors respectively. Figure A.2.1 and A.2.2 estimate the difference between density function under SAFTA and unilateral trade liberalisation in the urban sector. Figure A.2.1 shows that, in the short–run, there is a tendency that number of households whose monthly per capita expenditure between Rs.500-3000 will decrease marginally and there is a greater decline in the number of household who falls between this range in the long-run. There is a higher probability of decline in the number of households whose monthly per capital expenditure ranges from Rs500-4400 under the unilateral trade liberalisation.

Similar explanation can be seen in Figure A.3.1 and Figure A.3.2 under the rural sector with a difference in monthly household per capita expenditure between Rs300-2250 under the SAFTA and unilateral trade liberalisation between Rs300- 2270. There is a higher probability of decline in poverty in the rural sector than there is in the urban sector as the consequence of trade liberalisation. In Figure A.4.1 and Figure A.4.2 there is even higher probability of poverty decline in the estate sector with the implementation of SAFTA and unilateral trade liberalisation. There is a trend of moving from lower to a higher monthly per capita expenditure level in all the three sectors under both policy options. Further elucidation is followed in the FGT poverty indices illustrated in Tables 9 -11 for urban, rural and estate sectors in Sri Lanka.

Table 9 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Urban Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1767)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1761)			Long-Run (z=Rs.1757)			Short-Run (z=Rs.1707)			Long-Run (z=Rs.1705)		
		α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total	**100.00**	**7.32 (0.006)**	**1.50 (0.001)**	**0.53 (0.000)**	**7.12 (0.006)**	**1.46 (0.002)**	**0.51 (0.000)**	**6.90 (0.006)**	**1.43 (0.001)**	**0.50 (0.000)**	**5.01 (0.005)**	**1.16 (0.001)**	**0.41 (0.000)**	**4.87 (0.005)**	**1.15 (0.001)**	**0.40 (0.000)**
Decile 1	10	72.92 (0.036)	15.01 (0.014)	5.30 (0.007)	70.94 (0.037)	14.62 (0.014)	5.16 (0.007)	69.59 (0.038)	14.31 (0.014)	5.08 (0.007)	50.00 (0.041)	11.60 (0.013)	4.10 (0.006)	48.64 (0.041)	11.49 (0.013)	4.06 (0.006)
Decile 2	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 3	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: z= Poverty Line The respective standard errors are reported in parenthesis at 95% confidence limit

According to Table 9, it is apparent that poverty head count ratio (P0), poverty gap (P1) and poverty severity (P2) in the urban sector is 7.32 percent, 1.5 percent and 0.53 percent respectively. As shown in Table 9, the urban sector poverty is expected to decline under the SAFTA and unilateral trade liberalisation both in the short run and long run. Further, it is noted that poverty reduction in the urban sector is higher under the unilateral trade liberalisation in comparison to the SAFTA outcome due to non-discriminatory trade liberalisation. Moreover, decomposition of FGT indices based on household groups indicate that, only households belonging to the first decile fall below the poverty line in the base year, under SAFTA and unilateral trade liberalisation. For instance, in the base year 72.92 percent of the households in the first decile fall below the poverty line and in the short-run the same will be reduced to 70.94 percent and 50 percent under the SAFTA and unilateral trade liberalisation respectively. As indicated from the estimated results this is expected to further decline in the long run under the above mentioned trade policy options.

As illustrated in Table 10, it is noted that poverty is higher in the rural sector in comparison to the urban sector. For instance, in the base year poverty head count ratio (P0), poverty gap (P1) and poverty severity (P2) in the rural sector is 16.02 percent, 4.27 percent and 1.07 percent respectively. Similar to the urban sector, poverty is expected to be reduced in the rural sector under the aforesaid trade policy scenarios both in the short run and in the long run.

FGT decomposition by household groups indicate that, in the rural sector almost all the households belonging to the first decile and 60.14 percent of the households in the second decile fall below the poverty line in the base year. However, in the short-run, under the SAFTA all households in the first decile and 53.11 percent of the households in the second decile will fall below the poverty line. Under the unilateral trade liberalisation scenario this is expected to further reduce as figures indicate that all households in the first decile and 22.15 percent of the households belonging to the second decile will fall below the poverty line. Similar to the urban sector, poverty is expected to be reduced further in the long-run under these trade policy options in the said household groups.

Table 10 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Rural Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1652)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1641)			Long-Run (z=Rs.1634)			Short-Run (z=Rs.1586)			Long-Run (z=Rs.1576)		
		α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total	**100.00**	**16.02** (0.003)	**4.27** (0.003)	**1.07** (0.004)	**15.31** (0.004)	**4.10** (0.003)	**1.01** (0.001)	**14.95** (0.003)	**4.01** (0.003)	**0.97** (0.001)	**12.21** (0.003)	**3.41** (0.003)	**0.74** (0.003)	**11.08** (0.003)	**3.30** (0.003)	**0.71** (0.003)
Decile 1	10	100 (0.000)	38.86 (0.033)	10.55 (0.003)	100 (0.000)	37.96 (0.033)	9.99 (0.003)	100 (0.000)	37.43 (0.033)	9.67 (0.003)	100 (0.000)	33.48 (0.036)	7.54 (0.002)	100 (0.000)	32.65 (0.036)	7.51 (0.002)
Decile 2	10	60.14 (0.015)	3.88 (0.001)	0.34 (0.001)	53.11 (0.016)	3.11 (0.001)	0.24 (0.001)	49.48 (0.017)	2.68 (0.001)	0.20 (0.001)	22.15 (0.013)	0.64 (0.000)	0.025 (0.000)	18.01 (0.012)	0.40 (0.000)	0.012 (0.000)
Decile 3	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: z = Poverty Line The respective standard errors are reported in parenthesis at 95% confidence limit

Table 11 FGT Poverty Indices under the Base Year and Different Trade Policy Options: Estate Sector

Household Group	Population Share (%)	Base Year (z=Rs. 1570)			SAFTA						Unilateral Trade Liberalisation					
					Short-Run (z=Rs.1560)			Long-Run (z=Rs.1552)			Short-Run (z=Rs.1504)			Long-Run (z=Rs.1494)		
		α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2	α =0	α =1	α =2
		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Total	**100.00**	**24.20 (0.017)**	**4.93 (0.004)**	**1.65 (0.002)**	**23.36 (0.017)**	**4.66 (0.004)**	**1.56 (0.002)**	**23.02 (0.017)**	**4.48 (0.004)**	**1.50 (0.002)**	**17.31 (0.015)**	**3.44 (0.004)**	**1.17 (0.002)**	**16.30 (0.015)**	**3.27 (0.004)**	**1.11 (0.002)**
Decile 1	10	100 (0.00)	35.73 (0.018)	14.74 (0.019)	100 (0.00)	34.76 (0.018)	14.12 (0.019)	100 (0.00)	34.14 (0.018)	13.73 (0.019)	100 (0.00)	29.81 (0.019)	11.24 (0.019)	100 (0.00)	28.91 (0.020)	10.78 (0.019)
Decile 2	10	100 (0.00)	12.09 (0.005)	1.64 (0.001)	100 (0.00)	10.85 (0.005)	1.36 (0.001)	100 (0.00)	9.98 (0.005)	1.18 (0.001)	72.88 (0.057)	4.44 (0.005)	0.37 (0.005)	62.71 (0.063)	3.59 (0.004)	0.27 (0.001)
Decile 3	10	42.37 (0.064)	1.36 (0.002)	0.05 (0.000)	33.89 (0.061)	0.82 (0.002)	0.02 (0.000)	30.05 (0.059)	0.52 (0.001)	0.01 (0.000)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 4	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 5	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 6	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 7	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 8	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 9	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)
Decile 10	10	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)	0.0 (0.00)

Source: Author's estimation from the CFS 2003/04 and Results from SAMGEM

Note: z = Poverty Line The respective standard errors are reported in parenthesis at 95% confidence limit

Table 11 illustrates the poverty profile in the estate sector in Sri Lanka. From the estimated results, it is seen that in the base year poverty head count ratio (P0), poverty gap (P1) and poverty severity (P2) in the estate sector is 24.20 percent, 4.93 percent and 1.65 percent respectively. From this it is clear that the highest poverty is recorded in the estate sector in comparison to the urban and rural sectors in Sri Lanka as indicated by the Kernel density functions illustrated form Figures 10 -12.

As can be seen in the other two sectors with the implementation of the two trade policies, poverty is expected to decline in the estate sector as well. The decomposition of FGT indices by household groups indicates that the households belonging to the first three deciles fall below the poverty line in the base year, which means that 100 percent of households in the first two deciles and 42.37 percent of the households in the third deciles fall below the poverty line. Under the SAFTA, it is apparent that, in the short-run, the same situation prevails in the first two deciles, however, there is a fall in poverty in households belonging to the third deciles up to 33.89 percent. Nevertheless, under the unilateral trade liberalisation, it can be noted that poverty prevails only among the households in the first two deciles and all households in the third deciles fall above the poverty line.

By examining the base year (2003/04) poverty profiles in Sri Lanka it can be seen that, the poverty in terms of head count ratio (P0) in the urban sector is the lowest (7.32 percent) and estate sector is the highest (24.2 percent) while in rural sector it records 16.02 percent. DCS (2006/07) noted that the rural population consists of 82 percent of the total population, reflecting its highest population share, thus the highest number of poor persons is recorded from the rural sector. This is also clear from the sample size indicated in Table 2, as the sample size has been selected according to the population size of the respective sectors. As noted in Table 11, although the poverty in the estate sector is the highest among all three sectors, estate sector population consists of less than 5 percent of the total population in Sri Lanka. Hence, it is revealed that, in overall there is a higher incidence of poverty in rural provinces (including estate sector) and the rural sector of Western province in Sri Lanka.

Economic growth in Sri Lanka after trade liberalisation in 1977 has largely been limited to the urban manufacturing and services sector located in the country's Western province

where capital city is located, leaving agricultural households, especially those in remote provinces with little or no growth in consumption and income. According to the Central Bank Annual Report of Sri Lanka (2004), the composition of GDP originating from agriculture has declined during the last two decades and its contribution to GDP is just over 17 percent, the share of the industry has been steady at 27-28 percent while the service sector is the dominant sector which contributes about 54 percent as a share of GDP. Further, the Central Bank Report explained that, the share of employment in agriculture, industry and services was 30.2 percent, 25 percent and 44.8 percent respectively in 2004. By comparing the output and employment structures it is clear that the labour productivity is very low in agriculture, where nearly a one third of the workers are engaged in producing just one-sixth of the country's value added. Hence, agricultural productivity growth is fundamental for a reduction in poverty levels especially in rural and estate sectors in Sri Lanka as nearly 90 percent of the poor live in the rural agricultural economy.

The World Bank (2007) noted that the estate sector households suffered from disadvantages similar to the rural poor households. These include remoteness, poor infrastructural facilities, low level and poor quality education and dependence on agriculture for livelihoods. The only difference between rural poor and estate sector households is in access to public health services, which is worse in the estate sector. Hence, it is apparent that one of the main reasons for the high incidence of poverty in the estate sector is associated with lack of mainstream economic infrastructure in such areas in the country.

All countries in the world, including Sri Lanka, have committed themselves to attaining the targets embodied in the Millennium Declaration Goals by 2015. Eradicating extreme poverty and hunger constitutes the first MDG. For this reason, it is worthwhile to investigate the poverty level over the period 1990-2004 and examine the prospects of Sri Lanka attaining the first MDG of halving the incidence of consumption poverty between 1990 and 2015. Table 12 illustrates the poverty trend by sectors and also under different trade policy options as indicated by the poverty head count ratio. In calculating poverty head count ratio at the national level minimum monthly per capita expenditure Rs. 1526 (see Section 3.1) is taken as the poverty line and this is adjusted by changing the consumer price index for Sri Lanka in calculating poverty head count index under the SAFTA and unilateral trade liberalisation at the national level. According to the

results obtained from SAMGEM, under the SAFTA, the estimated national poverty line in the short run and long run would be Rs.1517 and Rs. 1512 respectively and under the unilateral trade liberalisation, the poverty line in the short-run is estimated as Rs.1467 and the same in the long-run is Rs.1461.

Table 12 Poverty Trends by Sectors from 1990-2004 and under Different Trade Policy Options

Sector	1990/91 (%)	2003/04* (Base Year) (%)	SAFTA*		Unilateral Trade Liberalisation*		Target in 2015 (%)
			SR (%)	LR (%)	SR (%)	LR (%)	
National	26.1	18.3	17.7	17.4	14.3	14.2	13.1
Urban	16.1	7.3	7.1	6.9	5.0	4.8	8.1
Rural	29.4	16.2	15.3	14.9	12.2	11.1	14.7
Estate	20.5	24.2	23.4	23.0	17.3	16.3	10.2

Source: Department of Census and Statistics (DCS), based on HIES 1990-91
*Note: Author's estimation from the CFS 2003/04 and Results from SAMGEM

As indicated in Table 12, it is evident that the poverty head count ratio in Sri Lanka has declined from 26.1 percent in 1990/91 to 18.3 percent in 2004 and this is expected to further decline under the SAFTA and unilateral trade liberalisation. As can be seen from Table 1, Sri Lanka has already achieved these targets by 2009/10 except in the estate sector. Hence, it can be seen that Sri Lanka has made a significant progress towards poverty reduction.

The calculated poverty indices (see Tables 10-12) under the SAFTA and unilateral trade liberalisation suggest that there is a reduction in poverty in urban, rural and estate sectors in Sri Lanka. In order to test the significance of the results indicated in Tables 10 -12, a "t" test has been used by calculating the "t" values taking the standard deviations reported in parenthesis for respective poverty indices. These values are reported in Appendix A.6. The critical "t" value, when α=0.025 from the "t" table is indicated as 1.96. As the calculated 't" values are greater than this critical "t" value it can be concluded that the poverty indices reported in Tables 10 -12 are significant at five percent significance level (95 percent confidence limit).

6. Concluding Remarks

It is widely accepted that trade liberalisation accelerates economic growth which would lead to poverty reduction in developing countries. Sri Lanka has achieved positive economic growth rates over the period of 1995-2009 except in 2001 due to the terrorist attacks on Sri Lanka's international airport and military targets in the USA on September 11 and their aftermath. It is clear that there is a significant reduction in poverty of Sri Lanka over the period of 1990/91 and 2009/10. In applying the results obtained from the SAMGEM to analyse income inequality using S-Gini co-efficients in the DAD programme, the results suggest that the inequality in urban, rural and estates sectors in Sri Lanka, is reduced in overall as well as between different household groups under the SAFTA and unilateral trade liberalisation. It is also suggested that the inequality is highest in the urban and lowest estate sector while rural sector falls between the two. Furthermore, estimated FGT indices indicated that poverty is highest in the estate sector followed by the rural sector and urban sector. It is also expected that the poverty in all three sectors decline under the two trade policies and the poverty reduction is higher under the unilateral trade liberalisation than under the SAFTA. Hence, it is obvious that Sri Lanka is progressing towards achieving the first MDG by 2015. For this reason, it can be concluded that trade liberalisation in Sri Lanka per se has a positive impact both in theory and practice.

It is the duty of the Sri Lankan government and policy makers of the country to transfer the benefits of trade liberalisation to the less developed and economically backward regions in rural and estate sectors (Central, Sabaragamuwa, Uva and Southern provinces) where most of the poor people are living in the country. Moreover, clear and focused initiatives are needed to enhance productivity in the agricultural sector accompanied by infrastructure development, which is especially important in provinces in the rural and estate sector provinces.

Another important issue to be concerned is that whether such growth benefits are equitably distributed among all sectors in the country. In this case policy makers need to make a clear focus on the question of equity vs. efficiency i.e. the tradeoff between investing scare resources in projects to uplift remote areas or investing in more profitable projects in urban growth centers. McCulloch Winters and Cirera (2001) explained that in order to yield stronger

results from an open trade regime, such policies must be accompanied by appropriate complementary policies, such as education, security well being, infrastructure, financial and macroeconomic policies. They also described that the precise mix of trade and other policies which are needed will depend on specific circumstances of each country. Hence, it is important that policy makers in Sri Lanka focus on the detailed pathways through which trade liberalisation can have positive impact on poor people and also distribute benefits from trade liberalisation more fairly among all parities in the country to alleviate inequality and poverty in Sri Lanka.

Acknowledgments

I am grateful to Professor Mahinda Siriwardana (principal supervisor) and Dr. Stuart Mounter (co-supervisor) for their helpful advices and comments on this paper. A special word of gratitude is due to Dr. Abdelkrim Araar at the Laval University in Canada for responding to my e-mail queries on how to use the DAD software for the income distribution analysis.

Appendix A.1

Percentage change in CPI under the SAFTA

	SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10
SR	-0.513	-0.417	-0.561	-0.562	-0.533	-0.423	-0.449	-0.394	-0.345	-0.331
LR	-0.763	-0.703	-0.852	-0.839	-0.800	-0.649	-0.679	-0.590	-0.513	-0.443
	SU1	**SU2**	**SU3**	**SU4**	**SU5**	**SU6**	**SU7**	**SU8**	**SU9**	**SU10**
SR	-0.359	-0.415	-0.451	-0.468	-0.393	-0.239	-0.315	-0.277	-0.270	-0.222
LR	-0.610	-0.714	-0.753	-0.697	-0.673	-0.465	-0.535	-0.361	-0.418	-0.313
	SE1	**SE2**	**SE3**	**SE4**	**SE5**	**SE6**	**SE7**	**SE8**	**SE9**	**SE10**
SR	-0.457	-0.658	-0.492	-0.607	-0.613	-0.276	-0.424	-0.262	-0.258	-0.234
LR	-0.761	-1.005	-0.793	-0.906	-0.924	-0.545	-0.665	-0.529	-0.306	-0.298

Percentage change in CPI under the unilateral trade liberalisation

	SR1	SR2	SR3	SR4	SR5	SR6	SR7	SR8	SR9	SR10
SR	-3.640	-3.434	-3.855	-3.824	-3.809	-3.503	-3.577	-3.477	-3.320	-3.250
LR	-3.762	-3.631	-4.094	-4.030	-3.992	-3.581	-3.678	-3.495	-3.265	-3.068
	SU1	**SU2**	**SU3**	**SU4**	**SU5**	**SU6**	**SU7**	**SU8**	**SU9**	**SU10**
SR	-3.490	-3.663	-3.580	-3.748	-3.600	-3.148	-3.390	-2.961	-3.154	-2.991
LR	-3.633	-3.930	-3.866	-3.841	-3.828	-3.222	-3.451	-2.922	-3.056	-2.749
	SE1	**SE2**	**SE3**	**SE4**	**SE5**	**SE6**	**SE7**	**SE8**	**SE9**	**SE10**
SR	-3.572	-4.251	-3.779	-4.054	-4.106	-3.278	-3.781	-3.291	-3.143	-3.054
LR	-3.824	-4.640	-4.035	-4.328	-4.414	-3.441	-3.923	-3.462	-3.387	-3.217

Source: Simulation results derived from SAMGEM

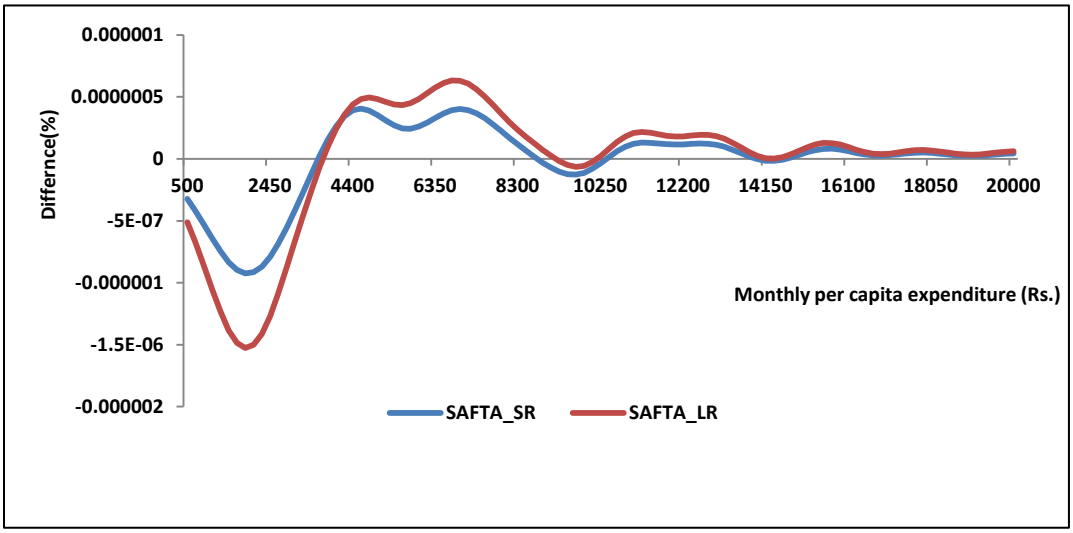
Note: SR-Short-Run LR-Long-Run

SR1-SR10 – Rural Household Groups SU1-SU10 – Urban Household Groups

SE1-SE10 – Estate Sector Household Groups

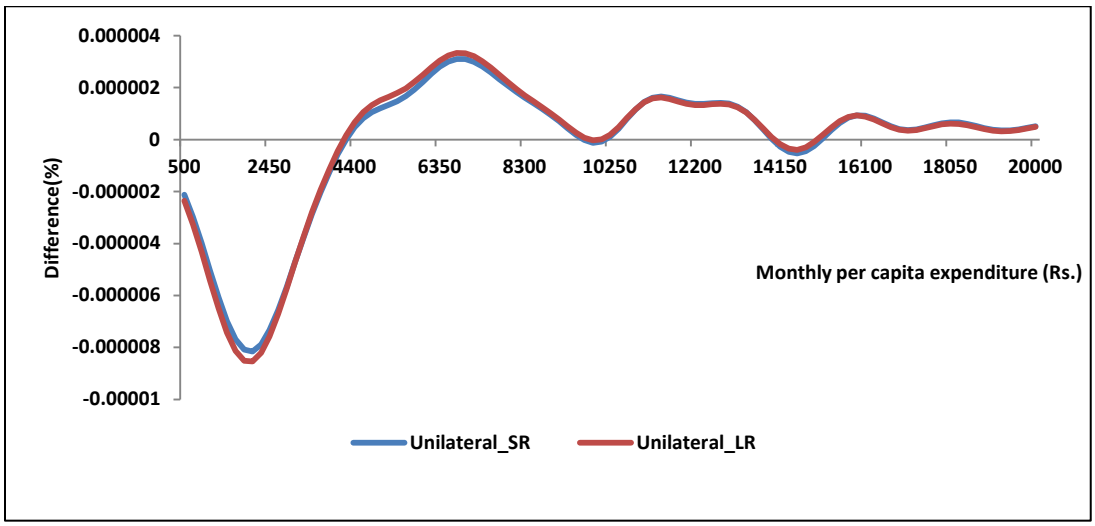
Appendix A.2

Figure A.2.1 Difference between Density Functions under SAFTA: Urban Sector



Source: Author's estimation from CFS, 2003/04

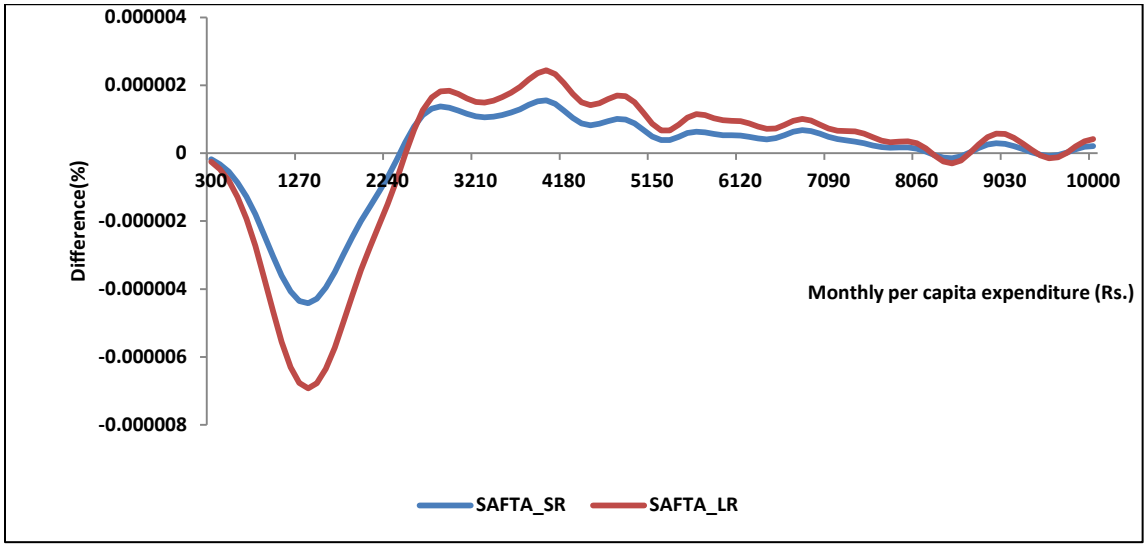
Figure A.2.2 Difference between Density Functions under Unilateral Trade Liberalisation: Urban Sector



Source: Author's estimation from CFS, 2003/04

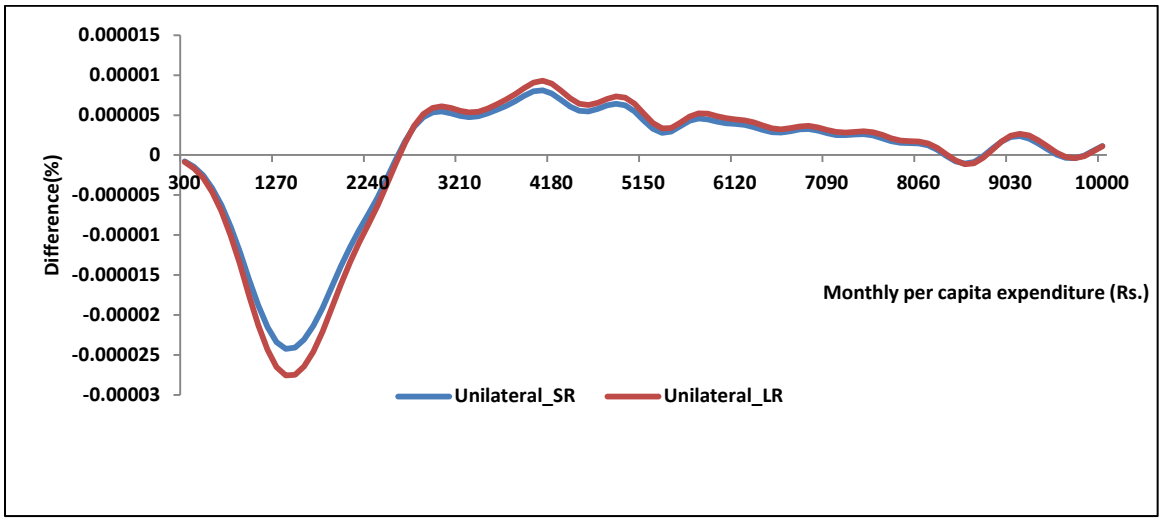
Appendix A.3

Figure A.3.1 Difference between Density Functions under SAFTA: Rural Sector



Source: Author's estimation from CFS, 2003/04

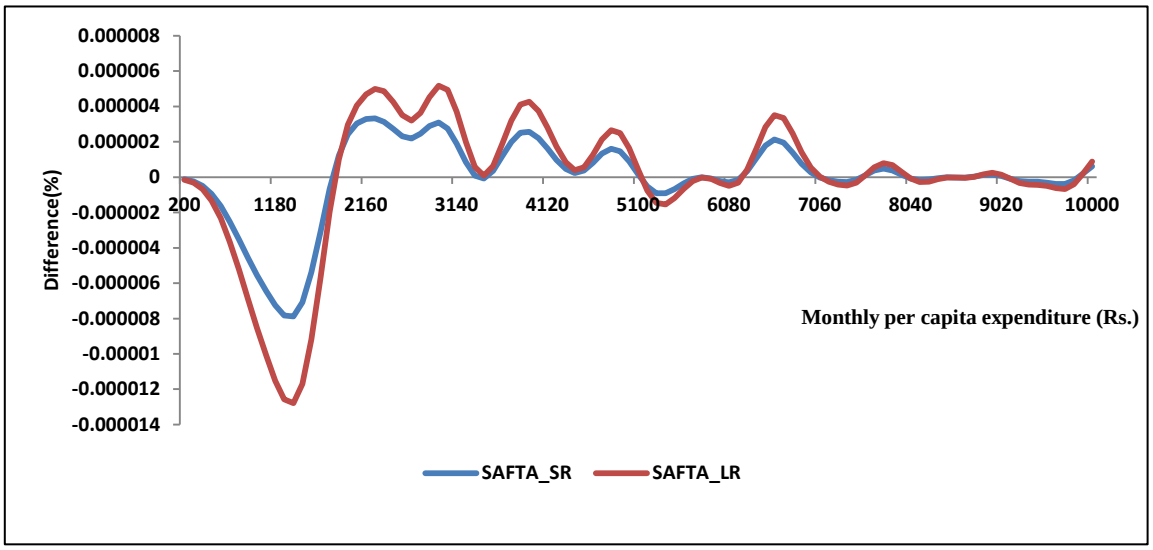
Figure A.3.2 Difference between Density Functions under Unilateral Trade Liberalisation: Urban Sector



Source: Author's estimation from CFS, 2003/04

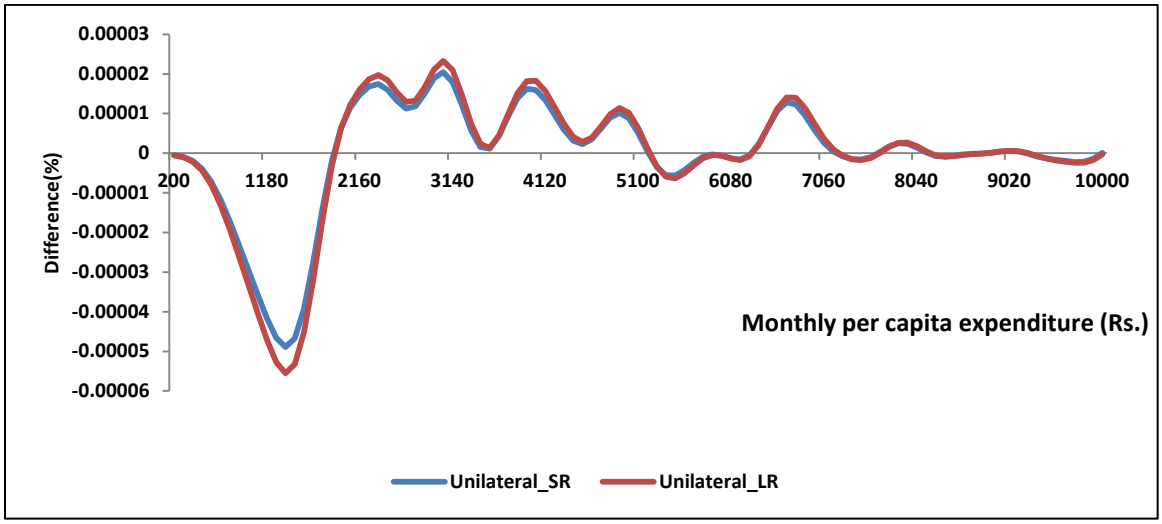
Appendix A.4

Figure A.4.1 Difference between Density Functions under SAFTA: Estate Sector



Source: Author's estimation from CFS, 2003/04

Figure A.4.2 Difference between Density Functions under Unilateral Trade Liberalisation: Estate Sector



Source: Author's estimation from CFS, 2003/04

Appendix A.5: Calculation of "t" values to Determine Statistical Significance of S-Gini Co-efficient

Test of Significance: "t" values for Urban Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.4658	0.0134	34.76	0.4655	0.0135	34.48	0.4651	0.0134	34.70	0.4646	0.0134	34.67	0.4637	0.0135	34.34
Between Groups	0.4525	0.0135	33.51	0.4522	0.0137	33.00	0.4518	0.0133	33.97	0.4513	0.0136	33.18	0.4504	0.0134	33.61
Within Groups	0.0133	0.0014	9.5	0.01333	0.00142	9.36	0.01332	0.00132	10.09	0.0133	0.0013	10.23	0.0133	0.0013	10.23
Gini by Households															
Decile 1	0.1226	0.0085	14.42	0.1226	0.0085	14.34	0.1226	0.0085	14.42	0.1226	0.0085	14.34	0.1226	0.0085	14.34
Decile 2	0.0435	0.0015	29.0	0.0435	0.0015	28.13	0.0435	0.0015	28.13	0.0435	0.0015	28.13	0.0435	0.0015	28.13
Decile 3	0.0321	0.0012	26.75	0.0321	0.0012	25.55	0.0321	0.0012	25.55	0.0321	0.0012	25.55	0.0321	0.0012	25.55
Decile 4	0.0339	0.0013	26.07	0.0339	0.0013	25.99	0.0339	0.0013	25.99	0.0339	0.0013	25.99	0.0339	0.0013	25.99
Decile 5	0.0321	0.0012	26.75	0.0321	0.0011	26.81	0.0321	0.0011	26.81	0.0321	0.0011	26.81	0.0321	0.0011	26.811
Decile 6	0.0332	0.0012	27.66	0.0332	0.0011	28.00	0.0332	0.0011	28.00	0.0332	0.0011	28.00	0.0332	0.0011	28.00
Decile 7	0.0383	0.0014	27.36	0.0382	0.0014	26.26	0.0382	0.0014	26.26	0.0382	0.0014	26.26	0.0382	0.0014	26.26
Decile 8	0.0490	0.0018	27.22	0.0490	0.0018	27.18	0.0490	0.0018	27.18	0.0490	0.0018	27.18	0.0490	0.0018	27.18
Decile 9	0.0678	0.0029	23.37	0.0678	0.0029	22.68	0.0678	0.0029	22.68	0.0678	0.0029	22.68	0.0678	0.0029	22.68
Decile 10	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52	0.2737	0.0321	8.52

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Rural Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.4040	0.007	57.17	0.4033	0.007	57.61	0.4032	0.007	57.6	0.4026	0.007	57.51	0.4025	0.007	57.5
Between Groups	0.3911	0.006	65.18	0.3904	0.006	65.06	0.3903	0.006	65.05	0.38977	0.006	64.96	0.38970	0.006	64.95
Within Groups	0.01289	0.0001	128.9	0.01288	0.0005	25.76	0.01287	0.0004	32.17	0.01286	0.0006	21.43	0.01286	0.0005	25.72
Gini by Households															
Decile 1	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84	0.2584	0.0672	3.84
Decile 2	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77	0.0363	0.0005	64.77
Decile 3	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41	0.0275	0.0004	66.41
Decile 4	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21	0.0246	0.0003	69.21
Decile 5	0.0244	0.0003	69.94	0.0244	0.0003	69.93	0.0244	0.0003	69.93	0.0244	0.0003	69.93	0.0244	0.0003	69.93
Decile 6	0.0263	0.0003	69.62	0.0263	0.0003	69.63	0.0263	0.0003	69.63	0.0263	0.0003	69.63	0.0263	0.0003	69.63
Decile 7	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85	0.0283	0.0004	70.85
Decile 8	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06	0.0365	0.0005	69.06
Decile 9	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98	0.0559	0.0008	64.98
Decile 10	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94	0.3025	0.0178	16.94

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Estate Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total	0.2990	0.0134	22.31	0.29866	0.0134	22.28	0.29860	0.0134	22.28	0.29801	0.0134	22.23	0.29787	0.0134	22.22
Between Groups	0.2915	0.0135	21.59	0.29119	0.0136	21.41	0.29111	0.0135	21.56	0.29053	0.0136	21.36	0.29040	0.0135	21.51
Within Groups	0.0074	0.0001	74.0	0.0074	0.00013	56.92	0.0074	0.00013	56.92	0.0074	0.0001	74.0	0.0074	0.0001	74.0
Gini by Households															
Decile 1	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034	0.1053	0.02093	5.034
Decile 2	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17	0.02791	0.0014	19.17
Decile 3	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74	0.01882	0.0011	15.74
Decile 4	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05	0.0166	0.0009	17.05
Decile 5	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19	0.0220	0.0011	19.19
Decile 6	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92	0.0188	0.0011	16.92
Decile 7	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53	0.0272	0.0015	17.53
Decile 8	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11	0.02631	0.0017	15.11
Decile 9	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34	0.0399	0.0027	14.34
Decile 10	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28	0.1923	0.0305	6.28

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Appendix A.6: Calculation of "t" values to Determine Statistical Significance of FGT indices

Test of Significance: "t" values for Urban Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	7.32	0.006	1220	7.12	0.006	1186	6.9	0.006	1150	5.01	0.005	1002	4.87	0.005	974
α =1	1.5	0.001	1500	1.46	0.002	730	1.43	0.001	1430	1.16	0.001	1160	1.15	0.001	1150
α =2	0.53	0.000	infinity	0.51	0.000	infinity	0.5	0.000	infinity	0.41	0.000	infinity	0.4	0.000	infinity
Gini by Households															
Decile 1 **α =0**	72.92	0.036	2025	70.94	0.037	1917	69.59	0.038	1831	50	0.041	1219	48.64	0.041	1186
α =1	15.01	0.014	1072	14.62	0.014	1044	14.31	0.014	1022	11.6	0.013	892	11.49	0.013	883
α =2	5.3	0.007	752	5.16	0.007	737	5.08	0.007	725	4.1	0.006	683	4.06	0.006	676

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Rural Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	16.02	0.003	5340	15.31	0.004	3827	14.95	0.003	4983	12.21	0.003	4070	11.08	0.003	3693
α =1	38.86	0.033	1177	4.10	0.003	1366	4.01	0.003	1336	3.41	0.003	1136	3.3	0.003	1100
α =2	1.07	0.004	267	1.01	0.001	1010	0.97	0.001	970	0.74	0.003	246	0.71	0.003	236
Gini by Households															
Decile 1 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity
α =1	38.86	0.033	1177	37.96	0.033	1150	37.43	0.033	1134	33.48	0.036	930	32.65	0.036	906
α =2	10.55	0.003	3516	9.99	0.003	3330	9.67	0.003	3223	7.54	0.002	3770	7.51	0.002	3755
Decile 2 **α =0**	60.14	0.015	4009	53.11	0.016	3319	49.48	0.017	2910	22.15	0.013	1703	18.01	0.012	1500
α =1	3.88	0.001	3880	3.11	0.001	3110	2.68	0.001	2680	0.64	0.000	infinity	0.4	0.000	infinity
α =2	0.34	0.001	340	0.24	0.001	240	0.2	0.001	200	0.025	0.000	infinity	0.012	0.000	infinity

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

Test of Significance: "t" values for Estate Sector

Household Group	Base Year			SAFTA						Unilateral Trade Liberalisation					
				Short-Run			Long-Run			Short-Run			Long-Run		
	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t	μ	σ	t
Total **α =0**	24.2	0.017	1423	23.36	0.017	1374	23.02	0.017	1354	17.31	0.015	1154	16.3	0.015	1086
α =1	4.93	0.004	1232	4.66	0.004	1165	4.48	0.004	1120	3.44	0.004	860	3.27	0.004	817
α =2	1.65	0.002	825	1.56	0.002	780	1.5	0.002	750	1.17	0.002	585	1.11	0.002	555
Gini by Households															
Decile 1 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity
α =1	35.73	0.018	1985	34.76	0.018	1931	34.14	0.018	1896	29.81	0.019	1568	28.91	0.02	1445
α =2	14.74	0.019	775	14.12	0.019	743	13.73	0.019	722	11.24	0.019	591	10.78	0.019	567
Decile 2 **α =0**	100	0.000	infinity	100	0.000	infinity	100	0.000	infinity	72.88	0.057	1278	62.71	0.063	995
α =1	12.09	0.005	2418	10.85	0.005	2170	9.98	0.005	1996	4.44	0.005	888	3.59	0.004	897
α =2	1.64	0.001	1640	1.36	0.001	1360	1.18	0.001	1180	0.37	0.005	74	0.27	0.001	270
Decile 3 **α =0**	42.37	0.064	662	33.89	0.061	555	30.05	0.059	509	-	-	-	-	-	-
α =1	1.36	0.002	680	0.82	0.002	410	0.52	0.001	520	-	-	-	-	-	-
α =2	0.05	0.000	infinity	0.02	0.000	infinity	0.01	0.000	infinity	-	-	-	-	-	-

Source: Author's calculations from results estimated from DAD

Note: μ=Mean Value σ= Standard Deviation $t = \frac{\mu}{\sigma}$

The above figures have been round off in calculating the "t" values

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