

AGE AS A FACTOR DETERMINING INCOME INEQUALITY IN SRI LANKA

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I. INTRODUCTION

CHANGE in age structure is one of the important factors affecting the long-term behavior of income inequality trends. Although literature on the relationship between age and income inequality has increased considerably since Paglin (1975), empirical studies regarding developing countries are still not adequate. Even though the demographic transition is rapid in these countries, long-term data on income distribution by age structure are not widely available. In this context, Sri Lanka is a special case. On the one hand, demographic transition in Sri Lanka started quite early in comparison to other low-income countries. Implementation of free health facilities reduced the death rate by one-third in the mid-1940s. Furthermore, legalization of family planning programs in the early 1970s led to a significant decline in the birth rate. In addition, expansion of educational facilities and other social development achievements also influenced the rapid demographic transition. On the other hand, data on income distribution by age groups have been available in Sri Lanka since the 1960s. However, to the best of this author's knowledge, this paper is the first empirical illustration of the relationship between age and income inequality in Sri Lanka.

Age structure affects the level and trends of income inequality in developing countries in several ways. First, the population pyramid no longer exists in many developing countries, including Sri Lanka. With the considerable decline in the birth rate during the past two decades, the bottom age proportion of the total population (infants) has become smaller than that of the child population. A declining fertility rate and less infant care has accelerated female participation in the labor force. By contrast, employment opportunities have increased at a very low speed in these countries. As a result, unemployment remains a vital issue and income inequality exists.

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Secondly, in developing countries as a whole, the life expectancy rate increased by 16.2 years within thirty-five years, from 46 years in 1960 to 62.2 years in 1995. (For Sri Lanka, life expectancy values were 60 and 73 years in 1960 and 1996 respectively.) In other words, during the thirty-five years, longevity increased by approximately five months every year in developing countries. With the considerable decline in the birth rate and the growing longevity, there will be an increasing number of older people in many developing countries in the next two decades.

The aging population is no longer limited to being an issue for developed countries. Although the developed countries have a relatively large proportion of elderly, it is obvious that the elderly population is growing at a faster rate in developing countries. In the developed regions, the proportion of elderly population of 60 years and over increased from 15.5 per cent in 1980 to 18.3 per cent in 1995, with an average annual growth rate of 1.6 per cent, while in the developing regions the increase was from 5.2 per cent in 1980 to 6.9 per cent in 1995, with an average annual growth of 2.9 per cent. Since the income of older people is typically lower than that of the young, an increasing number of older people should lead to an increase in the number of income receivers with low income. Therefore, income inequality (in a sense, poverty) will increase with the changing age structure, unless appropriate policies are implemented.

Since Sri Lanka has quite an exceptional longevity both in relation to its income per capita and compared to that of many other low-income countries, changes in age structure affect the level and trends of income inequality much earlier than in other low-income countries. For example, in the South Asian context, Sri Lanka has the highest share of elderly population (population share above 55 years was 13.3 per cent in 1997) due to the emerging downward trends in fertility and mortality from the 1950s. The proportion of the age 60 and over population rose from 6.6 per cent of the total population in 1980 to 8.5 per cent in 1995, with a remarkable average annual growth rate of 3.4 per cent. This unprecedented growth of the elderly population is emerging not only as a current trend but will be reflected in the future demographic scenarios in Sri Lanka. Therefore, income distribution among elderly people will become a more important research area in Sri Lanka as well as in other developing countries in the near future.

Using decomposable inequality measurements and shift-share analysis, this paper analyzes the impact of age structure changes on income inequality trends in Sri Lanka during the 1963–87 period. Attempts have been made to identify possible policy implications for other developing countries also. However, this paper is devoted to analyzing only primary income distribution in Sri Lanka. Therefore, income distribution which adjusted for net transfers or price increases (real income distribution) has not been analyzed.

The outline of the paper is as follows. Section II explains the behavior of age structure and income inequality trend during the past four decades. Section III re-

views the literature on income distribution in Sri Lanka. Section IV describes the methods of analysis. Data, definitions, and limitations are explained in Section V. Section VI contains empirical findings, and decomposes the total income inequality by age in terms of location (sectors and regions), gender, and temporal changes. In addition, the elasticity of the Gini coefficient with respect to each age group is estimated in order to predict future patterns of income inequality associated with different age groups. Concluding remarks are given in the final section.

II. BEHAVIOR OF AGE STRUCTURE AND INCOME INEQUALITY TRENDS IN SRI LANKA, 1963–97

Table I summarizes the basic indices of age structure and income distribution during the 1963–97 period. Since the 1997 consumer finances survey report has not yet been published, data are not available to calculate several indices for that particular year. However, as indicated by the population shares, the share of the population aged less than 14 decreased from 41 per cent to 25 per cent while the share of population aged above 55 increased from 7 per cent to 13 per cent during the 1963–97 period. In addition, a notable increase in the population share (up 3 per cent) can be seen in the 46–55 age group during the 1986–97 period. However, population share changes in other age groups are not significant during the whole period.

In terms of share of income receivers, the 19–25 age group showed increasing (3 per cent) tendency during the 1963–78 period. Until 1982, the share of income receivers in the 26–35 group increased (by 3 per cent). Changes in income receivers shares in other age groups are not significant. There is quite an interesting relationship associated with the changes in population structure and the share of income receivers in the over 55 age group. The population share in the over 55 age group increased by 4 and 2 per cent respectively during the 1963–87 and 1987–97 periods. In the over 55 age group, the share of income receivers fluctuated marginally, and the relative income share increased by 3 per cent during the 1963–87 period.

As observed from Table I, the relative income share of the 26–35 age group marginally increased while that of the 36–45, and 46–55 age groups marginally decreased. During the whole period, mean income was positively related with age until 55 years. The mean income of the over 55 age group always remained less than that of the 36–45 and 46–55 age groups. The mean income for the total population increased by 580 per cent during the 1963–87 period. Population in the 19–25, 26–35, and over 55 age groups recorded far higher growth of mean incomes, registering 612, 637, and 605 per cent respectively. The lowest mean income growth was attributed to the 14–18 age group at 509 per cent.

In terms of the Gini coefficient, the highest level of income inequality was recorded by the over 55 age group until 1978. The highest value of the Gini coefficient was attributed to the 36–45 and 26–35 age groups in 1982 and 1987 respec-

TABLE I
BASIC INDICES OF AGE STRUCTURE AND INCOME DISTRIBUTION IN SRI LANKA, 1963-97

	1963	1973	1978/79	1981/82	1986/87	1996/97
A. Population share						
Less 14	0.41	0.39	0.34	0.34	0.31	0.25
14-18	0.12	0.11	0.12	0.11	0.12	0.12
19-25	0.11	0.12	0.14	0.14	0.13	0.12
26-35	0.12	0.12	0.14	0.14	0.14	0.14
36-45	0.10	0.10	0.10	0.10	0.11	0.13
46-55	0.07	0.07	0.08	0.08	0.08	0.11
Above 55	0.07	0.10	0.09	0.09	0.11	0.13
All groups	1.00	1.00	1.00	1.00	1.00	1.00
B. Share of income receivers						
Less 14	0.004	0.002	0.004	0.003	0.002	
14-18	0.05	0.03	0.05	0.04	0.03	
19-25	0.14	0.15	0.17	0.16	0.14	
26-35	0.24	0.25	0.26	0.27	0.26	
36-45	0.23	0.24	0.21	0.21	0.23	
46-55	0.18	0.15	0.16	0.17	0.17	
Above 55	0.15	0.16	0.15	0.14	0.16	
All groups	1.00	1.00	1.00	1.00	1.00	
C. Relative income share						
Less 14	0.001	0.0005	0.001	0.001	0.001	
14-18	0.02	0.01	0.02	0.01	0.01	
19-25	0.08	0.09	0.09	0.09	0.08	
26-35	0.22	0.24	0.25	0.26	0.26	
36-45	0.27	0.28	0.25	0.27	0.25	
46-55	0.24	0.20	0.21	0.20	0.21	
Above 55	0.16	0.18	0.18	0.17	0.19	
All groups	1.00	1.00	1.00	1.00	1.00	
D. Mean income in Sri Lanka rupees						
Less 14	88	133	182	251	586	
14-18	95	169	189	320	577	
19-25	146	268	330	624	1,040	
26-35	243	424	596	1,035	1,789	
36-45	315	537	732	1,387	1,959	
46-55	365	584	822	1,358	2,323	
Over 55	297	500	765	1,333	2,096	
All groups	267	455	617	1,111	1,817	
E. Gini coefficient for income receivers						
Less 14	0.18	0.36	0.22	0.28	0.41	
14-18	0.34	0.33	0.37	0.37	0.42	
19-25	0.39	0.38	0.42	0.47	0.48	
26-35	0.44	0.38	0.46	0.48	0.54	
36-45	0.48	0.37	0.47	0.53	0.47	
46-55	0.44	0.39	0.48	0.47	0.51	
Over 55	0.53	0.42	0.50	0.51	0.51	
All groups	0.51	0.41	0.50	0.52	0.52	0.48

TABLE I (Continued)

	1963	1973	1978/79	1981/82	1986/87	1996/97
F. Income receivers' decile income shares (%)						
1st	1.2	1.8	1.2	1.2	1.1	1.3
2nd	2.7	3.2	2.6	2.5	2.5	2.8
3rd	3.6	4.4	3.6	3.4	3.4	3.9
4th	4.6	5.7	4.8	4.5	4.4	4.9
5th	5.6	7.1	5.9	5.5	5.7	6.0
6th	6.8	8.8	7.4	6.9	6.8	7.3
7th	9.0	10.6	9.1	8.5	8.4	9.1
8th	11.5	12.7	11.4	10.7	11.1	11.5
9th	16.0	15.9	15.4	14.9	15.4	15.7
10th	39.2	30.0	38.7	41.8	41.9	37.6

- Sources: 1. Author's computations from the *Report on Consumer Finances and Socio-Economic Survey (RCFSES)*, Part II, 1963, 1973, 1978/79, 1981/82, and 1986/87. (Population shares and decile income shares are reproduced from the *RCFSES*).
 2. Central Bank of Sri Lanka, *Sri Lanka Socio-Economic Data*, 1998.

tively. Despite the lowest value of the Gini coefficient being seen in the less than 14 age group, their economic activities are not clear and may not be important in income distribution analysis. Even though child labor is a vital issue in developing countries, the less than 14 age group population is excluded from the definition of labor force. However, in the income receivers definition this age group is also included in Sri Lanka.

Figure 1 plots the behavior of the Gini coefficient by various methods of estimation and income units. According to the data given in Table I and Figure 1, it is possible to identify three main phases of income inequality trends in Sri Lanka as follows.

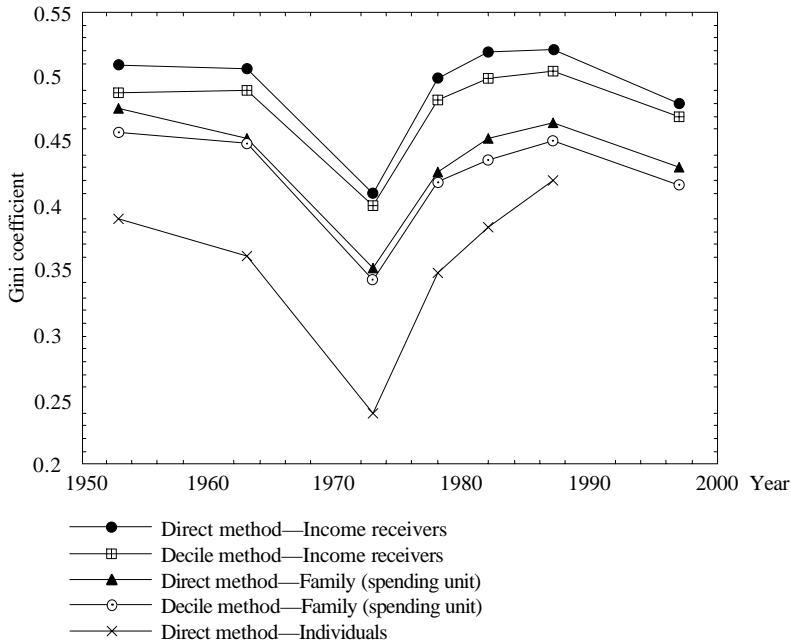
(1) Decreasing income inequality during the 1963–73 period

The Gini coefficient declined from 0.51 to 0.41 (or by 16 per cent) at the national level, 0.54 to 0.40 in the urban sector, 0.46 to 0.37 in the rural sector. The income share of the bottom 40 per cent of income receivers increased from 12 to 15 per cent while that of the top 20 per cent declined by 10 per cent.

(2) Increasing income inequality during the 1973–87 period

During the 1973–87 period, the Gini coefficient increased from 0.41 to 0.52 (by 21 per cent) at the national level, 0.40 to 0.53 in the urban sector, 0.37 to 0.50 in the rural sector. However, in considering government economic policies, this period can be divided into two subphases of inequality: (a) inward-looking development policy period (1973–77), and (b) outward-looking development policy period (1978–87). The former subphase represented 82 per cent of the inequality growth of the 1973–87 period.

Fig. 1. Behavior of the Gini Coefficient by Various Income Units and Methods of Estimation, 1953–97



(3) Decreasing income inequality during the 1987–97 period

During the 1987–97 period, the Gini coefficient decreased from 0.52 to 0.48 (by 8 per cent) at the national level. Although detailed income distribution data for 1997 have not yet been published, family income data (spending unit based) shows declining inequality in urban and rural sectors. The income share of the bottom 40 per cent of income receivers increased from 11.4 to 13 per cent while that of the top 20 per cent declined from 57.3 to 53.3, or by 4 per cent. This reduction in income inequality appeared during a period when privatization and deregulation programs were implemented under a policy of continuing economic liberalization.

A brief review of income distribution studies regarding Sri Lanka is given in the next section before the results of the analysis of trends in income inequality are presented.

III. REVIEW OF THE LITERATURE ON INCOME DISTRIBUTION IN SRI LANKA

There are three kinds of income distribution studies concerning Sri Lanka.¹ The first and initial group of studies are based on inequality measurements provided by

¹ For a detailed survey see Karunaratne (1999b).

official statistics and are highly descriptive. Rasaputra (1972), Jayawardena (1974), Karunatilake (1975, 1976, 1994), Lakshman (1980a, 1980b, 1997), Lee (1977), Jayasundara (1986), Ravallion and Jayasuriya (1988), are the major studies of this group.

Secondly, Oshima (1962, 1992), Paukert (1973), Fields (1980, 1995), World Bank (1990), Deininger and Squire (1996), UNDP (1997) are international studies which compare inequality level and trends in Sri Lanka with other developing countries. Most of these studies are also based on officially published inequality measurements along with the explanations given in the first group of studies.

Thirdly, Colombage (1976), Glewwe (1985, 1986, 1988), Bhalla and Glewwe (1986), Pyatt (1987), Divisekera and Felmingham (1988, 1989), Kakwani (1988), Terasaki (1993), Karunaratne (1998a, 1998b, 1999a, 1999b, 1999c, 1999d, forthcoming) are empirical studies on income distribution in Sri Lanka. These studies provide their own estimations of inequality measures and quantifiable factors behind the inequality trends in Sri Lanka.

Among the third-type of studies, only Terasaki (1993), and Karunaratne (1999b) present income inequality decomposition results by age in Sri Lanka. The former was based on income data given in the *Family Income and Expenditure Survey* conducted by the Department of Census and Statistics in the year 1990/91. The basic income unit was the household head. Since Terasaki used only one year of data, the impact of changes in age structure on income distribution was not analyzed. However, he identified employment status, education level, occupation, and sector as main determinants of income inequality in Sri Lanka, while showing a low contribution of between-age-group component (2.3 per cent) in the total income inequality in 1990/91.

Karunaratne (1999b), decomposed total income inequality by age for the year 1963, 1973, 1978/79, 1981/82, and 1986/87. In addition, using shift-share analysis, temporal changes of income inequality measures were decomposed into various inequality components for the four subperiods during the 1963–87 period. Data were obtained from the *Report on Consumer Finances and Socio-Economic Survey* conducted by the Central Bank of Sri Lanka in 1963, 1973, 1978/79, 1981/82, and 1986/87. The basic income unit was the income receiver. Among the various other findings, the growing importance of the between-age-group component and sectoral differences in age effect were also identified.

As shown in the above literature survey, empirical studies regarding the effects of long-term changes in age structure on income inequality in Sri Lanka are very limited. Therefore, this paper attempts to fill this gap.

IV. THE METHODS OF ANALYSIS

This paper utilizes two Theil's entropy measures (T and L) and variance of the logarithm of income (LV) as the group decomposable income inequality measures.

They are defined as follows:²

$$T = \sum_i \sum_j \left(\frac{y_{ij}}{Y} \right) \log \left(\frac{y_{ij}/Y}{n_{ij}/N} \right) = \sum_i \left(\frac{Y_i}{Y} \right) T_i + \sum_i \left(\frac{Y_i}{Y} \right) \log \left(\frac{Y_i/Y}{N_i/N} \right) = T_w + T_B, \quad (1)$$

$$L = \sum_i \sum_j \left(\frac{n_{ij}}{N} \right) \log \left(\frac{n_{ij}/N}{y_{ij}/Y} \right) = \sum_i \left(\frac{N_i}{N} \right) L_i + \sum_i \left(\frac{N_i}{N} \right) \log \left(\frac{N_i/N}{Y_i/Y} \right) = L_w + L_B, \quad (2)$$

$$LV = \frac{1}{N} \sum_i \sum_j n_{ij} (x_{ij} - x_{..})^2 = \sum_i \left(\frac{N_i}{N} \right) LV_i + \sum_i \left(\frac{N_i}{N} \right) (x_i - x_{..})^2 = LV_w + LV_B, \quad (3)$$

where

$$Y_i = \sum_j y_{ij}, N_i = \sum_j n_{ij}, Y = \sum_i \sum_j y_{ij}, N = \sum_i \sum_j n_{ij},$$

i = income class,

j = (age) group,

y_{ij} = income of the j -th group in the i -th income class,

n_{ij} = number of income receivers of the j -th group and i -th income class,

Y = total income,

N = total number of income receivers,

x_{ij} = log value of the income of income receivers in i -th class and j -th population group,

x_i = mean income of i -th class $x_i = \frac{1}{N} \sum_j n_{ij} x_{ij}$,

$x_{..}$ = mean income of x_{ij} over i and j , where $x_{..} = \frac{1}{N} \sum_i \sum_j n_{ij} x_{ij}$.

T_i , L_i , and LV_i refer to the respective inequality measures for the j -th group; T_w , L_w , and LV_w refer to the within-group income inequality component, and T_B , L_B , and LV_B refer to the between-group income inequality component. This between-group component reflects the inequality contribution due solely to differences in subgroup mean incomes. According to Mookherjee and Shorrocks (1982), when inequality decomposition is performed by age, the between-group component of inequality corresponds to the pure "age effect." However, the difference between T and L is that the T index is sensitive to upper income categories while the L index is sensitive to lower income categories. Since the pattern of inequality measured by the Theil T and L indices are similar in Sri Lanka, and the Theil L index is the strictly decomposable inequality measure, this study focuses only on the Theil L index to illustrate the age effect at sectoral and regional levels, as well as by gender and temporal changes in inequality components.

In addition to the group decomposition indices, so-called shift-share analysis is also used to explain the magnitude of the temporal changes in inequality components. In other words, shift-share analysis indicates the extent to which the changes in different factors contribute to changes in aggregate income inequality. Following Mookherjee and Shorrocks (1982), temporal changes of inequality contributions

² For details see Anand (1983, pp. 302–54).

can be obtained by applying the difference operator to both sides of the Theil indices. In the case of the Theil *L* index it can be written as follows:³

$$\Delta L = \sum_j v_j \Delta L_i + \sum_j L_j \Delta v_j - \sum_j \log k_j \Delta v_j - \sum_j v_j \Delta \log k_j, \tag{4}$$

(term A) (term B) (term C) (term D)

where v_j is the income receivers share of the group j and k_j is the income share of the j -th group.

In addition to above inequality measures, the Gini coefficient is also used to explain the trends of income inequality. It is defined as follows:

$$G = \sum_{i=1}^{n-1} (N_i/N) \cdot (Y_{i+1}/Y) - \sum_{i=1}^{n-1} (N_{i+1}/N) \cdot (Y_i/Y) \tag{5}$$

where

- G = Gini coefficient,
- n = number of income classes,
- Y_i = cumulative income,
- Y = total income,
- N_i = cumulative number of income receivers,
- N = total number of income receivers,

so that

- N_i/N = cumulative proportion of the number of income receivers,
- Y_i/Y = cumulative proportion of income.

The Lorenz curve can be obtained by taking N_i/N data as the horizontal axis and Y_i/Y data as the vertical axis. As demonstrated in Appendix A-I, to calculate the Gini coefficient from various subgroups of population, equation (5) can be extended to the following equation.

$$G = \sum_{k=1}^m W_k C_k, \tag{6}$$

where

- G = total-income based Gini coefficient,
- m = number of population subgroups,
- W_k = share of the k -th subgroup income in total income,
- C_k = concentration coefficient of the k -th subgroup (pseudo-Gini coefficient).⁴

Following Podder (1993), assuming intra-group inequality is constant, it is possible to calculate the elasticity of the Gini coefficient with respect to the k -th age group (η_k) as follows:⁵

³ The derivation process of equation (4) from equation (2) is available in Mookherjee and Shorrocks (1982, pp. 896–97).
⁴ See, for example, Rao (1969), Pyatt (1976), Fei, Ranis, and Kuo (1978), and Podder (1993), Karunaratne (1999b). See also Appendix B.
⁵ See Appendix A-II for the derivation of equation (7) from equation (6).

$$\eta_k = \frac{1}{G} [W_k(C_k - G)]. \quad (7)$$

The advantage of formula (7) is that the sign of η_k indicates the effect of the k -th subgroup on total income inequality. However, one important limitation of η_k is the assumption of constant intra-group inequality (C_k).

V. DATA, DEFINITIONS, AND LIMITATIONS

The data used in this paper have been obtained from the following sources:

(1) *Report on Consumer Finances and Socio-Economic Survey* (hereafter *RCFSES*) published by the Central Bank of Sri Lanka. Surveys were conducted in the year 1953, 1963, 1973, 1978/79, 1981/82, 1986/87, and 1996/97.

(2) *Sri Lanka Socio-Economic Data 1998* (hereafter *SSED*).

When this study was begun, the 1986/87 *RCFSES* survey was the latest detailed consumer finances survey. Although a detailed *RCFSES* for 1996/97 has not yet been published, some data of that survey is available in *SSED*. Therefore, in order to indicate the latest situation in income distribution, this paper used the *SSED* data also. However, data given in the *SSED* is not sufficient to do a decomposition analysis. As a result, the analytical presentation is limited to the 1963–87 period.

The sample size was 8,000 households in the *RCFSES* in 1987. Sri Lanka has nine provinces, which include twenty-four administrative districts. Surveys were conducted in all districts and provinces in 1953, 1963, 1973, 1978/79, and 1981/82. However, since 1983 they have not been conducted in the northern and eastern provinces due to civil war. In 1998 those two provinces represented 14.8 per cent of the total population and 28 per cent of the land area of Sri Lanka.

This paper used income receivers as the income unit to analyze income distribution. This is because in the above mentioned surveys household head or individual-based data were not available to decompose total income by age. In the 1987 *RCFSES* an income receiver is defined as “a person who has received an income from any source whatsoever (employment, transfer, rent, own business, dividend etc.) during the six months immediately prior to the date of visit was treated.”

In this paper, the total population is divided into seven age subgroups, namely, years less than 14, 14–18, 19–25, 26–35, 36–45, 46–55, and over 55. According to *RCFSES* data, age 55 is the retirement age. However, there are some controversial arguments about retirement age in Sri Lanka. As indicated in Perera (1994), “the government of Sri Lanka has fixed the optional age of retirement for males at 55 years and for females at 50 years with 60 and 55 as compulsory retirement ages for males and females respectively. In the private sector 60 is considered the retirement age and in institutions of higher learning the limit is fixed at 65. These age limits, however, are flexible, depending on the exigencies of service” (p. 133). In this pa-

per age 55 is considered as the retirement age in Sri Lanka for the following reasons. First, individual data related to income receivers over 55 years of age are not available in the *RCFSES* series from 1963 to 1987. Therefore, the over 55 age group must be considered as a single group in our analysis. Second, the male-female retirement age gap was eliminated by the government in the late 1970s. Third, for government school teachers age 55 is the fixed retirement age. (However, some teachers work after age 55 on a temporary basis). Therefore, as far as permanent employment positions are concerned, it is possible to consider age 55 as the retirement age for both male and female government school teachers.

Sri Lanka has three economic sectors, namely, urban, rural, and estates. The urban sector consists of the people in the municipal, urban, and town council areas. Manufacturing and services are the main economic activities in the urban sector. The estate sector consists of the people in tea, rubber, and coconut estates with twenty or more acres and with ten or more resident workers. Plantation agriculture is the main economic activity in the estate sector. The rural sector consists of the people not included in the urban or the estate sectors. Traditional agriculture (which produces rice, grain, vegetables, fruit, etc.) is the main economic activity in the rural sector. In 1997 the urban, rural, and estate sectors represented 22, 72, and 6 per cent of the total population respectively.

The *RCFSES* provides income data on a zonal (hereafter regional) basis also. The whole island is divided into five regions. Regional classification by administrative districts can be given as follows.

Region 1 consists of income receivers in the districts of Colombo (excluding households in Colombo Municipality), Gampaha, Kalutara, Galle, and Matara.

Region 2 consists of income receivers in the districts of Hambantota, Moneragala, Ampara, Polonnaruwa, Anuradhapura, and Puttalam.

Region 3 consists of income receivers in the districts of Jaffna, Mannar, Vavuniya, Mullaitivu, Kilinochchi, Trincomalee, and Batticaloa.

Region 4 consists of income receivers in the districts of Kandy, Matale, Nuwara-Eliya, Badulla, Ratnapura, Kegalle, and Kurunegala.

Region 5 consists of income receivers in Colombo Municipality.

VI. DECOMPOSITION RESULTS

This section presents the empirical results of decomposition organized as follows. In subsection A, using three inequality measurements, the national-level income inequality is decomposed by income-receiver age groups. In subsection B, sectoral- and regional-level income inequality is decomposed by age groups to understand the locational differences of the age effect. In part C, each age group's income inequality is decomposed by sector, region, and gender. Subsection D utilizes shift-share analysis to quantify the changing contribution of inequality components to

income inequality trends. Finally the elasticity of the Gini coefficient with respect to different age groups is estimated in subsection E in order to predict future behavioral patterns of the inequalities associated with different age groups.

A. *Income Inequality Decomposition by Age in the National Economy*

Empirical results of income inequality decomposition by age are given in Table II. When dealing with summary inequality statistics it is always possible that the pattern of results obtained with one index differs from that obtained with another. Therefore, Table II presents results obtained from three inequality measures (T , L , and LV as defined above). Contribution of the age effect to the total income inequality is slightly different among the three measures. In 1963 the age of income receivers could explain 9.5, 12.3, and 11.3 per cent of the total income inequality measured by the T , L , and LV measures respectively. However, in the 1970s these figures were around 11, 14, and 15 per cent of the total income inequality respectively. By 1987 the importance of the age effect declined to 6.5, 8.2, and 11.9 per cent respectively. Therefore, the contribution of the age effect to the total income inequality measured by all three indices showed a modest inverted-U shape behavior during the 1963–87 period. This behavior contradicts the trends of aggregate income inequality. As mentioned above, the aggregate income inequality measured by the Gini coefficient decreased in the 1963–73 period and increased in the 1973–87 period. The statistics given in Table II (aggregate values of T , L , and LV) also confirm this pattern of inequality. Even though the magnitude of the age effect declined in the 1980s, it contributed more than 10 per cent to the total income inequality in the 1970s. However, when considering the whole period, age is neither a powerful nor a negligible factor in determining level and trends of income inequality in Sri Lanka.

B. *Income Inequality Decomposition by Age in Sectors and Regions*

When economic development advances, changes in age structure occur not only in the time path but also by sectors and regions due to natural population growth differences and internal migration. In the initial stage of economic development, the birth rate declines rapidly in metropolitan and urban areas in comparison to rural backward areas. As a result, urban female youths participate in education and the labor force while rural female youths remain as housemaids or unpaid family workers. Therefore, income inequality between female youths in rural and urban sectors increases. In addition, when development take place, youth labor concentrates in cities, leaving elderly people in rural agricultural activities. Since the mean income of the manufacturing and service industries in the urban sector is quite high in comparison to that of rural agriculture, youth labor migration from rural to urban areas increases the urban-rural income gap and thereby accelerate the aggregate income inequality. The impact of these kinds of development features on income distribution can be captured by comparing the age effect sectorally and regionally.

TABLE II
INCOME INEQUALITY DECOMPOSITION BY INCOME RECEIVERS' AGE, 1963-87

Age Group	1963	1973	1978	1982	1987
A. Theil T index					
Less 14	0.01	0.10	0.16	0.06	0.14
14-18	0.09	0.09	0.11	0.14	0.19
19-25	0.13	0.10	0.15	0.24	0.24
26-35	0.17	0.11	0.22	0.22	0.27
36-45	0.20	0.11	0.20	0.28	0.19
46-55	0.26	0.13	0.23	0.19	0.22
Over 55	0.25	0.14	0.22	0.23	0.21
Aggregate inequality	0.23	0.13	0.23	0.25	0.24
Within-age-group component	0.21	0.12	0.21	0.23	0.22
	(90.5)	(88.5)	(89.5)	(91.9)	(93.5)
Age effect	0.022	0.015	0.024	0.020	0.015
	(9.5)	(11.5)	(10.5)	(8.1)	(6.5)
B. Theil L index					
Less 14	0.06	0.11	0.12	0.07	0.13
14-18	0.11	0.08	0.11	0.12	0.16
19-25	0.12	0.11	0.15	0.18	0.22
26-35	0.16	0.11	0.18	0.19	0.24
36-45	0.19	0.11	0.18	0.22	0.18
46-55	0.22	0.12	0.19	0.17	0.20
Over 55	0.25	0.14	0.20	0.21	0.21
Aggregate inequality	0.21	0.13	0.20	0.22	0.23
Within-age-group component	0.18	0.12	0.17	0.19	0.21
	(87.7)	(86.5)	(85.2)	(88.4)	(91.8)
Age effect	0.03	0.02	0.03	0.03	0.02
	(12.3)	(13.5)	(14.8)	(11.6)	(8.2)
C. Variance of logarithm of income (LV)					
Less 14	0.30	0.17	0.10	0.14	0.15
14-18	0.13	0.12	0.10	0.13	0.22
19-25	0.10	0.11	0.11	0.14	0.35
26-35	0.13	0.17	0.15	0.23	0.37
36-45	0.14	0.21	0.17	0.26	0.33
46-55	0.13	0.21	0.17	0.26	0.34
Over 55	0.13	0.21	0.15	0.23	0.34
Aggregate inequality	0.20	0.20	0.21	0.22	0.36
Within-age-group component	0.18	0.17	0.18	0.19	0.32
	(88.7)	(83.6)	(85.8)	(87.5)	(88.0)
Age effect	0.02	0.03	0.03	0.03	0.04
	(11.3)	(16.4)	(14.2)	(12.6)	(11.9)

Source: Author's computations from the *RCFSES*, Part II, 1963, 1973, 1978/79, 1981/82, and 1986/87.

Note: Figures in parentheses are percentages.

For this purpose, Table III presents our decomposition results for the 1963–87 period by sector, region, and at the national level. Because of the need for strict decomposability but limited space, the empirical results presented in Table III are limited to the Theil *L* index only.

As shown in the last column of Table III, the magnitude of the age effect is different among sectors and regions for each year. In terms of sectors, the contribution of the age effect to the total income inequality is significant in the urban sector. For example, age differences of income receivers contributed to the total urban income inequality by 16, 12, 17, 15, and 13 per cent in 1963, 1973, 1978, 1982, and 1987 respectively. However, the age effect in the rural sector was recorded as 11, 11, 13, 9, and 7 per cent for those respective years. In particular, after the introduction of liberalized economic policies (in 1978), the importance of age as a factor determining inequality decreased in the rural sector. Changes in industrial structure were one of the important factors behind this situation. According to Karunaratne (1999b), during the 1978–87 period, the share of the agricultural industry in total rural income declined (from 45 to 37 per cent), while the share of construction (5 to 6 per cent) and services (31 to 35 per cent) increased. Increasing employment opportunities in the construction and service industries led to a reduction in the importance of the age effect in the rural sector. This was due to considerable absorption of unemployed youth in these industries during the 1978–82 period. There is no age limitation for employment opportunities in the construction industry and internal services such as retail and wholesale trade, real estate, and ownership of dwellings.

During the 1963–87 period, the age effect on the total income inequality fluctuated considerably in the estate sector. Even though it accounted for 18 per cent of the total income inequality in the estate sector in 1973, its importance at the national level was limited to 13 per cent due to the lesser importance of the share of the estate sector income in the national economy. However, the importance of the age effect in the estate sector was lowest in 1987. Since labor unions are strong in the estate plantation industry in Sri Lanka, wage differences among age groups remained as the lowest of any sector in the 1980s.

Inequality decomposition results by age for different regions are also provided in Table III. In our analysis, region 5 is incorporated into region 1 for 1963. Data on region 3 is not available for 1987. The importance of the age effect on total income inequality also varies among regions. Region 5 represents the highest contribution of the age effect to total income inequality. In particular in 1978, the age of income receivers contributed 23 per cent of the total income inequality in region 5. Since region 5 represents the capital city of Sri Lanka, it is the most populated, urbanized, and commercialized area. As seen in the above sectoral analysis, the age effect is significant in urbanized areas in Sri Lanka. In order to understand the background factors behind this situation, a close look at mean income by age structure is necessary. In region 5, during the whole period, the highest and the lowest mean incomes

TABLE III
INCOME INEQUALITY DECOMPOSITION BY INCOME RECEIVERS' AGE AT SECTORAL,
REGIONAL, AND NATIONAL LEVELS, 1963-87

Year	Location	Theil <i>L</i> Index for Each Age Group						Aggregate Inequality (<i>L</i>)	Within-Age-Group Component	Age Effect (<i>LB</i>)	% of <i>LB</i>	
		0-13	14-18	19-25	26-35	36-45	46-55					Over 55
1963	Urban	0.03	0.11	0.11	0.17	0.18	0.25	0.26	0.23	0.19	0.04	16
	Rural	0.05	0.14	0.15	0.14	0.16	0.18	0.23	0.19	0.17	0.02	11
	Estate	—	0.05	0.03	0.06	0.12	0.06	0.10	0.07	0.07	0.00	4
	Region 1	0.03	0.16	0.13	0.20	0.19	0.25	0.30	0.24	0.21	0.03	12
	Region 2	0.10	0.11	0.24	0.12	0.15	0.22	0.31	0.20	0.19	0.01	7
	Region 3	—	0.04	0.12	0.13	0.15	0.15	0.20	0.16	0.15	0.01	7
	Region 4	0.02	0.09	0.07	0.12	0.18	0.18	0.22	0.17	0.15	0.03	15
	All island	0.06	0.11	0.12	0.16	0.19	0.22	0.25	0.21	0.18	0.03	12
1973	Urban	—	0.08	0.08	0.10	0.11	0.12	0.17	0.13	0.11	0.02	12
	Rural	0.13	0.11	0.11	0.09	0.10	0.10	0.12	0.11	0.10	0.01	11
	Estate	—	0.03	0.05	0.10	0.07	0.16	0.20	0.11	0.09	0.02	18
	Region 1	0.05	0.08	0.12	0.12	0.13	0.16	0.14	0.15	0.13	0.02	12
	Region 2	0.15	0.12	0.08	0.08	0.08	0.07	0.15	0.10	0.09	0.01	13
	Region 3	—	0.08	0.05	0.06	0.06	0.10	0.10	0.08	0.07	0.01	16
	Region 4	—	0.06	0.08	0.11	0.10	0.09	0.13	0.12	0.10	0.02	17
	Region 5	—	0.03	0.08	0.12	0.08	0.10	0.19	0.13	0.11	0.02	12
All island	0.11	0.08	0.11	0.11	0.11	0.12	0.14	0.13	0.12	0.02	13	
1978	Urban	0.03	0.14	0.12	0.14	0.17	0.24	0.22	0.21	0.17	0.04	17
	Rural	0.16	0.13	0.18	0.19	0.17	0.15	0.18	0.20	0.17	0.03	13
	Estate	0.01	0.05	0.08	0.08	0.06	0.14	0.15	0.09	0.08	0.01	9
	Region 1	0.03	0.08	0.16	0.17	0.16	0.13	0.18	0.18	0.16	0.02	12
	Region 2	—	0.14	0.20	0.17	0.21	0.22	0.25	0.24	0.20	0.04	16
	Region 3	0.01	0.11	0.11	0.24	0.16	0.16	0.22	0.21	0.18	0.03	16
	Region 4	0.21	0.11	0.13	0.15	0.16	0.17	0.19	0.19	0.15	0.03	17
	Region 5	0.13	0.15	0.10	0.15	0.25	0.37	0.24	0.27	0.21	0.06	23
All island	0.12	0.11	0.15	0.18	0.18	0.19	0.20	0.20	0.17	0.03	15	
1982	Urban	0.02	0.09	0.13	0.18	0.26	0.22	0.25	0.24	0.20	0.04	15
	Rural	0.11	0.16	0.22	0.19	0.19	0.14	0.18	0.20	0.18	0.02	9
	Estate	0.07	0.04	0.05	0.08	0.08	0.08	0.09	0.08	0.07	0.01	14
	Region 1	0.10	0.12	0.13	0.17	0.17	0.16	0.16	0.18	0.16	0.02	12
	Region 2	0.06	0.25	0.20	0.19	0.18	0.15	0.24	0.21	0.19	0.02	11
	Region 3	0.02	0.09	0.22	0.16	0.22	0.12	0.16	0.20	0.17	0.03	13
	Region 4	0.04	0.07	0.23	0.19	0.26	0.17	0.22	0.24	0.21	0.03	12
	Region 5	0.00	0.05	0.12	0.21	0.24	0.29	0.36	0.27	0.22	0.05	19
All island	0.07	0.12	0.18	0.19	0.22	0.17	0.21	0.22	0.19	0.03	12	
1987	Urban	0.03	0.08	0.12	0.26	0.17	0.19	0.23	0.23	0.20	0.03	13
	Rural	0.24	0.22	0.26	0.23	0.17	0.18	0.18	0.22	0.20	0.01	7
	Estate	—	0.05	0.09	0.09	0.07	0.09	0.10	0.09	0.08	0.01	6
	Region 1	0.15	0.13	0.15	0.22	0.17	0.19	0.16	0.20	0.18	0.02	10
	Region 2	0.06	0.13	0.21	0.28	0.19	0.22	0.23	0.24	0.22	0.02	8
	Region 4	0.10	0.18	0.24	0.19	0.13	0.17	0.19	0.20	0.18	0.02	8
	Region 5	—	0.10	0.11	0.36	0.25	0.30	0.38	0.32	0.28	0.05	15
	All island	0.13	0.16	0.22	0.24	0.18	0.20	0.21	0.23	0.21	0.02	8

Source: Same as for Table II.

were attributed to the 46–55 and less than 14 age groups respectively. In 1978 the highest mean income recorded by the 46–55 age group of 2, 261 (Sri Lanka rupees) was nine times higher than that of the less than 14 and 14–18 age groups. This difference between the highest and the lowest mean income remained high during the whole period.

The decomposition results given in Tables II and III indicate that during the entire period a large part of the total inequality is contributed by the within-age-group component. The within-age-group share remained higher than 83 per cent of the total inequality as measured by all three inequality measures. As seen from the first three equations, the within-age-group component consists of two variables, namely, income share or population share of each age group and the inequality index for the relevant age group. In order to understand the factors behind the high within-age-group income inequality, each age group inequality was decomposed by sector, region, and gender. Our attempt in the next section is to understand what percentage of within-age-group income inequality can be explained by sector, region, and gender differences of the income receiver. For this process also, the Theil L index is used as the inequality measure.

C. Decomposition of the Income Inequality of Each Age Group by Location and Gender

Decomposition results of the income inequality by sector of each age group are given in Table IV. The Gini coefficient for each age group by sector is also provided to illustrate the inequality behavior in each group. In terms of the Gini coefficient in 1982, the highest income inequality was recorded by the 36–45 age group in the urban sector. It declined by 18 per cent during the 1982–87 period. However, the 46–55 and over 55 age groups in the urban sector also showed a significant level of income inequality during the whole period. In the rural sector, in comparison to the urban sector, the Gini coefficient was high among relatively young income receivers such as the 14–18, 19–25, and 26–35 age groups. Two reasons can be given for this situation. First, unemployment among educated youths is high in the rural sector in comparison to the urban sector. Secondly, in the rural sector a small portion of the young employees engaged in nonagricultural activities and their mean income is higher than that of the large portion of young people who engaged only in agricultural activities. However, in the estate sector, income inequality was high among the 26–35 and over 55 age groups. Sectoral differences in production structure, factor utilization, unemployment rate, and government intervention may be the significant factors influencing the level of income inequality in each age group in the three sectors. Further analysis of factors behind the sectoral differences of income inequality in Sri Lanka is available in Karunaratne (1999a).

As demonstrated from the decomposed L index results (Table IV), sectoral differences of location are an important factor of income inequality for the 26–35, 36–

TABLE IV (Continued)

Age Group	Location	Theil <i>L</i> Index					Gini Coefficient				
		1963	1973	1978	1982	1987	1963	1973	1978	1982	1987
	Rural	0.23	0.12	0.18	0.18	0.18	0.47	0.39	0.48	0.48	0.46
	Estate	0.10	0.20	0.15	0.09	0.10	0.27	0.49	0.42	0.33	0.36
	National (<i>L</i>)	0.25	0.14	0.20	0.21	0.21	0.53	0.42	0.50	0.51	0.51
	Within group (<i>LW</i>)	0.23	0.14	0.19	0.19	0.18					
	Between group (<i>LB</i>)	0.02	0.00	0.01	0.01	0.02					
	% of <i>LB</i>	9.1	3.0	4.2	7.1	11.4					
All groups	Urban	0.23	0.13	0.21	0.24	0.23	0.54	0.40	0.51	0.54	0.53
	Rural	0.19	0.11	0.20	0.20	0.21	0.47	0.37	0.49	0.49	0.50
	Estate	0.07	0.12	0.09	0.08	0.09	0.29	0.37	0.32	0.32	0.31
	National (<i>L</i>)	0.21	0.14	0.20	0.22	0.23	0.51	0.41	0.50	0.52	0.52
	Within group (<i>LW</i>)	0.17	0.12	0.19	0.19	0.20					
	Between group (<i>LB</i>)	0.04	0.02	0.02	0.02	0.03					
	% of <i>LB</i>	17.1	13.2	8.7	10.3	11.0					

Source: Same as for Table II.

45, and 46–55 age groups. This is because the portion of between-group inequality is sizable for these age groups. As shown in the bottom row of Table IV, for the aggregate income inequality recorded by the total population in 1987, 11 per cent was contributed by the sectoral differences of mean income. That was 17.1 per cent in 1963. With regards to the 26–35 age group, sectoral differences in mean income contributed 18.5 per cent of the income inequality in 1963. However, the importance of these differences has been gradually declining during the last two decades. In addition, the between-sector component associated with the less than 14 and 14–18 age groups is not sizable. This is because inequality associated with these two age groups is concentrated in the within-sector component. However, more than 10 per cent of the total income inequality associated with other age groups can be explained by the sectoral differences in mean incomes.

The income inequality of each age group is also decomposed by region and the results are summarized in Table V. According to the empirical findings, the location of income receivers by region is a significant factor only in determining income inequality in the less than 14 age group. During the 1963–87 period, the between-region share of inequality for this group varied from 8 per cent to 53 per cent. Since this group is not in the labor force, we have not investigated factors behind this situation. In addition, in 1973, 22 per cent of the inequality was contributed by the regional mean income differences for income receivers in the 19–25 age group. The mean income for the 19–25 age group was recorded as (Sri Lankan rupees) 314, 324, 359, 207, and 551 in the five regions respectively. Since economic activities in region 4 are mainly concentrated in plantation agriculture, the low wage income in that industry contributed to the low mean income. Manufacturing and service in-

TABLE V
DECOMPOSITION OF AGE GROUP INCOME INEQUALITY BY REGION, 1963–87

Age Group	Location	Theil <i>L</i> Index				
		1963	1973	1978	1982	1987
Less 14	Income inequality	0.04	0.13	0.12	0.07	0.13
	Within region (<i>LW</i>)	0.04	0.06	0.11	0.06	0.10
	Between region (<i>LB</i>)	0.005	0.07	0.01	0.01	0.02
	% of <i>LB</i>	11	53	8	14	18
14–18	Income inequality	0.11	0.08	0.11	0.19	0.15
	Within region (<i>LW</i>)	0.11	0.07	0.11	0.19	0.15
	Between region (<i>LB</i>)	0.002	0.01	0.00	0.00	0.00
	% of <i>LB</i>	2	15	3	1	1
19–25	Income inequality	0.12	0.13	0.15	0.12	0.20
	Within region (<i>LW</i>)	0.10	0.10	0.14	0.11	0.19
	Between region (<i>LB</i>)	0.02	0.03	0.01	0.01	0.01
	% of <i>LB</i>	13	22	4	5	3
26–35	Income inequality	0.16	0.11	0.18	0.19	0.25
	Within region (<i>LW</i>)	0.15	0.11	0.17	0.18	0.23
	Between region (<i>LB</i>)	0.01	0.01	0.01	0.01	0.02
	% of <i>LB</i>	7	8	7	4	8
36–45	Income inequality	0.19	0.11	0.18	0.22	0.17
	Within region (<i>LW</i>)	0.18	0.10	0.17	0.22	0.16
	Between region (<i>LB</i>)	0.01	0.01	0.01	0.00	0.01
	% of <i>LB</i>	4	7	5	1	7
46–55	Income inequality	0.22	0.12	0.19	0.17	0.20
	Within region (<i>LW</i>)	0.21	0.11	0.17	0.16	0.19
	Between region (<i>LB</i>)	0.02	0.01	0.02	0.01	0.01
	% of <i>LB</i>	8	7	9	5	7
Over 55	Income inequality	0.26	0.14	0.20	0.20	0.20
	Within region (<i>LW</i>)	0.26	0.14	0.20	0.20	0.19
	Between region (<i>LB</i>)	0.00	0.00	0.01	0.01	0.01
	% of <i>LB</i>	1	3	3	4	7
All groups	Income inequality	0.21	0.13	0.20	0.22	0.23
	Within region (<i>LW</i>)	0.20	0.13	0.19	0.21	0.22
	Between region (<i>LB</i>)	0.01	0.01	0.01	0.00	0.01
	% of <i>LB</i>	5	6	4	2	6

Source: Same as for Table II.

dustries were the main sources of income in region 5 (the capital city). Therefore, the mean income in that region was as high as 551 rupees in comparison to the national mean income for this group of 455 rupees. With the introduction of liberalization policies in 1977, the importance of agriculture as an income source declined greatly in several regions and as a result, the difference of the mean income

among regions declined considerably. Therefore, the between-region share of the aggregate income inequality was not at a significant level during the 1978–87 period. Even for the aggregate income inequality recorded by the entire population, regional differences of mean income (between-group components) contributed less than 7 per cent during the whole period. Therefore, locational differences by region of income receivers are not a significant factor in determining levels and trends of income inequality in Sri Lanka.

Apart from location, the gender of income receivers was also investigated as a possible factor determining inequality for each age group. The empirical findings are summarized in Table VI. Since income data for each age group are not available by gender in the 1963, 1973, and 1978 surveys, the analytical part of this paper is limited to the 1982–87 period. According to the data given in Table VI, in 1987 male-female differences in mean income were significant only for the less than 14 and the 36–45 age groups (10 per cent of total income inequality was associated with these age groups). The between-group share for other income groups was not sizable. However, as indicated by the values of the Gini coefficient for the over 55 age group, elderly female income was unequally distributed during the 1982–87 period. The Gini coefficient for this group was 0.67 and 0.52 in 1982 and 1987 respectively. As seen in Section II, the over 55 age group population increased at a considerable rate. Therefore, policymakers must pay attention to reducing income inequality associated with females in the over 55 age group to reduce total income inequality in Sri Lanka.

D. *Temporal Changes in Income Inequality by Age: A Shift-Share Analysis*

Temporal changes in income inequality measured by the Theil L index at the sectoral and national levels are given in Table VII. Since the actual numerical values are very small, for purposes of presentation the true figures have been raised by a factor of 1,000. (A similar step was also taken by Mookerjee and Shorrocks [1982].) Considering data availability, the whole period (1963–87) is divided into four subperiods and at the bottom of the table, a breakdown over the long term is also provided. As liberalized economic policies were introduced in 1978, it is better to consider 1978–87 as one separate income inequality period.

In the first inequality subperiod (1963–73) as measured by the Theil L index, the total income inequality at the national level decreased by 71, and 65 of this was from the within-age-group component. The effects of the shift of population structure by age on within-group inequality (term B) was positive but almost negligible. Two between-group inequality components (terms C and D) also had negative values during this period. During the first inequality subperiod, the effect of the changes in group mean incomes on temporal change in inequality (term D) was negative and quite sizable in the urban sector in comparison to the other two sectors. The component of within-age-group income inequality (20 out of 30) made a large con-

TABLE VI
DECOMPOSITION OF AGE GROUP INCOME INEQUALITY BY GENDER, 1982-87

Age Group	Gender	Theil <i>L</i> Index		Gini Coefficient	
		1982	1987	1982	1987
Less 14	Male	0.10	0.15	0.34	0.44
	Female	0.02	0.04	0.18	0.49
	Both	0.07	0.11	0.28	0.41
	Within group (<i>LW</i>)	0.07	0.10		
	Between group (<i>LB</i>)	0.001	0.01		
	% of <i>LB</i>	1.5	10.1		
14-18	Male	0.13	0.11	0.39	0.41
	Female	0.10	0.17	0.32	0.44
	Both	0.12	0.13	0.37	0.42
	Within group (<i>LW</i>)	0.12	0.13		
	Between group (<i>LB</i>)	0.002	0.0004		
	% of <i>LB</i>	1.4	0.3		
19-25	Male	0.19	0.24	0.48	0.50
	Female	0.15	0.16	0.43	0.41
	Both	0.18	0.22	0.47	0.48
	Within group (<i>LW</i>)	0.18	0.22		
	Between group (<i>LB</i>)	0.01	0.01		
	% of <i>LB</i>	4.0	2.8		
26-35	Male	0.17	0.24	0.46	0.52
	Female	0.20	0.23	0.50	0.52
	Both	0.19	0.25	0.48	0.54
	Within group (<i>LW</i>)	0.18	0.24		
	Between group (<i>LB</i>)	0.01	0.01		
	% of <i>LB</i>	7.6	5.3		
36-45	Male	0.19	0.15	0.49	0.45
	Female	0.23	0.18	0.54	0.47
	Both	0.22	0.18	0.53	0.47
	Within group (<i>LW</i>)	0.20	0.16		
	Between group (<i>LB</i>)	0.02	0.02		
	% of <i>LB</i>	10.3	10.0		
46-55	Male	0.14	0.18	0.43	0.49
	Female	0.23	0.21	0.64	0.51
	Both	0.17	0.20	0.47	0.51
	Within group (<i>LW</i>)	0.16	0.19		
	Between group (<i>LB</i>)	0.01	0.01		
	% of <i>LB</i>	5.6	6.9		
Over 55	Male	0.18	0.18	0.56	0.49
	Female	0.27	0.22	0.67	0.52
	Both	0.21	0.20	0.51	0.51
	Within group (<i>LW</i>)	0.20	0.19		
	Between group (<i>LB</i>)	0.004	0.007		
	% of <i>LB</i>	2.1	3.6		

TABLE VI (Continued)

Age Group	Gender	Theil <i>L</i> Index		Gini Coefficient	
		1982	1987	1982	1987
All group	Male	0.20	0.19	0.49	0.51
	Female	0.23	0.21	0.53	0.51
	Both	0.22	0.21	0.52	0.52
	Within group (<i>LW</i>)	0.20	0.20		
	Between group (<i>LB</i>)	0.01	0.01		
	% of <i>LB</i>	6.1	6.1		

Source: Same as for Table II.

TABLE VII

DECOMPOSITION OF TEMPORAL CHANGES IN INCOME INEQUALITY
BY AGE AT SECTOR AND NATIONAL LEVELS

(Theil *L* × 1,000)

Period	Sector / Region	Change in Aggregate Inequality	Contribution to Change in Theil <i>L</i> Due to			
			Within-Group Inequality (Term A)	Effect of Population Share on		Effect of Group Mean Income on Inequality (Term D)
				Within-Group Inequality (Term B)	Between-Group Inequality (Term C)	
1963-73	Urban	-101	-79	-3	-8	-12
	Rural	-73	-65	2	-8	-2
	Estate	30	20	-3	5	8
	National	-71	-65	1	-4	-3
1973-78	Urban	74	61	-2	21	-6
	Rural	81	73	0	15	-7
	Estate	-18	-3	-6	11	-21
	National	67	59	-1	15	-6
1978-82	Urban	32	31	1	-9	9
	Rural	0	8	1	-9	0
	Estate	-10	-14	2	-6	8
	National	14	18	1	-11	5
1982-87	Urban	-15	-6	3	-9	-3
	Rural	15	21	0	-9	3
	Estate	9	15	3	-16	6
	National	11	19	1	-12	3
1978-87	National	25	37	3	-22	8
1963-87	National	24	27	2	-8	3

Source: Same as for Table II.

Note: If computed using the figures in Table II or Table III, the results will be slightly different because of the rounding off at the intermediate level of calculation.

tribution to the positive changes in the aggregate inequality in the estate sector. However, the effect of group mean income on inequality change in the estate sector was positive and considerable in comparison to the other two sectors and the national economy.

In the second subperiod of income inequality (1973–78), inequality measured by the Theil *L* index (in 1,000 terms) increased by 74, 81, and 67 in the urban, rural, and national economy while it declined (by 18) in the estate sector. There are two important features of component changes in this period. First is the positive and considerable effect of term C. The effect of population share on between-group income inequality at the urban, rural, estate, and national level was recorded as 21, 15, 11, and 15. These figures are the highest positive values for all subperiods recorded by term C. In the urban sector, in particular, it was as high as 21 (of a total 74). Secondly, declining inequality in the estate sector was largely generated by the negative effect of the group mean income (term D).

The inequality increase in the third subperiod (1978–82) was also largely due to the sizable changes in the within-age-group component. However, total inequality measured by the Theil *L* index did not change in the rural sector due to the positive within-group component (terms A and B) and negative between-group (terms C and D) effects of inequality components. As far as the national economy is concerned, the effect of the population share on between-group inequality was negative and significant in this period.

Inequality increased in the fourth subperiod (1982–87) also, due to the positive and notable within-age-group component. Income inequality in the urban sector decreased due to the negative contribution of the within-age-group component as well as the negative effect of population share on the between-age-group inequality (term C). This negative contribution of term C was influential in keeping the nationwide inequality growth at a low level. At the national level, the within-age-group component was 19, while term C was recorded as –12. As a result, the total inequality changed only by 11 during the 1982–87 period.

During the whole period 1963–87, a large part of the changes in the aggregate income inequality was contributed by the within-age-group inequality component (term A) in all three sectors and the national economy. However, during the 1978–87 period, the changing population share contributed a sizable negative portion to the between-group income inequality. This situation kept the total income inequality growth at a low level after the introduction of liberalized economic policies. In other words, if the population structure had not changed during the 1978–87 period, the national level Theil *L* index would have been 0.2479 (an 8 per cent higher value) instead of the actual value of 0.2288 recorded for 1987.

A similar kind of prediction of inequality components can be easily obtained by using the elasticity of the Gini coefficient as proposed by Podder (1993). The next section presents empirical findings using this method.

E. *The Elasticity of the Gini Coefficient for Each Age Group*

The estimated elasticity figures are given in Table VIII. The signs of the elasticity figures imply the direction in which each age group will affect the total income inequality. A negative sign implies the inequality-reducing ability of that age group, while a positive sign indicates the opposite. For example, if the concentration coefficient of the 14–18 age group does not change, the increasing relative income share

TABLE VIII
THE ELASTICITY OF THE GINI COEFFICIENT FOR EACH AGE GROUP AT THE SECTORAL AND NATIONAL LEVEL, 1963–87

Age Group	1963	1973	1978	1982	1987
A. Urban sector					
Less 14	-0.0035	-0.0009	-0.0018	-0.0018	-0.0021
14–18	-0.0215	-0.0176	-0.0191	-0.0147	-0.0144
19–25	-0.0532	-0.0918	-0.0812	-0.0690	-0.0661
26–35	-0.0300	-0.0353	-0.0455	-0.0446	-0.0032
36–45	0.0186	0.0824	0.0427	0.0616	0.0039
46–55	0.0847	0.0685	0.0720	0.0424	0.0444
Over 55	0.0049	-0.0053	0.0342	0.0261	0.0374
B. Rural sector					
Less 14	-0.0031	-0.0016	-0.0015	-0.0008	-0.0004
14–18	-0.0229	-0.0213	-0.0217	-0.0232	-0.0125
19–25	-0.0577	-0.0818	-0.0663	-0.0727	-0.0457
26–35	-0.0293	-0.0468	-0.0091	-0.3041	-0.0036
36–45	0.0463	0.0639	0.0362	-0.0250	0.0113
46–55	0.0502	0.0632	0.0370	0.0372	0.0431
Over 55	0.0166	0.0243	0.0254	-0.0025	0.0077
C. Estate sector					
Less 14	-0.0013	—	-0.0013	-0.0027	-0.0011
14–18	-0.0643	-0.0712	-0.1003	-0.1904	-0.0708
19–25	-0.1399	-0.1960	-0.1160	-0.3496	-0.1056
26–35	-0.0035	-0.0278	0.0237	-0.2694	-0.0465
36–45	0.1013	0.0839	0.0587	0.0314	0.1157
46–55	0.0850	0.1574	0.1174	0.0681	0.0783
Over 55	0.0227	0.0537	0.0178	0.0347	0.0299
D. National					
Less 14	-0.0028	-0.0011	-0.0015	-0.0013	-0.0008
14–18	-0.0275	-0.0252	-0.0278	-0.0201	-0.0157
19–25	-0.0668	-0.0905	-0.0770	-0.0611	-0.0526
26–35	-0.0282	-0.0341	-0.0192	-0.0265	-0.0068
36–45	0.0381	0.0614	0.0365	0.0496	0.0103
46–55	0.0658	0.0645	0.0526	0.0326	0.0420
Over 55	0.0214	0.0249	0.0365	0.0268	0.0236

Source: Same as for Table II.

of that age group will lead to a decreased total income inequality. This is because the elasticity of the Gini coefficient for that age group is negative. The estimated elasticity figures for all three sectors and at the national level indicate similar signs during the whole period. The elasticity figures for income receivers in the less than 14, 14–18, 19–25, and 26–35 age groups indicate negative signs, while for all other groups they are positive.

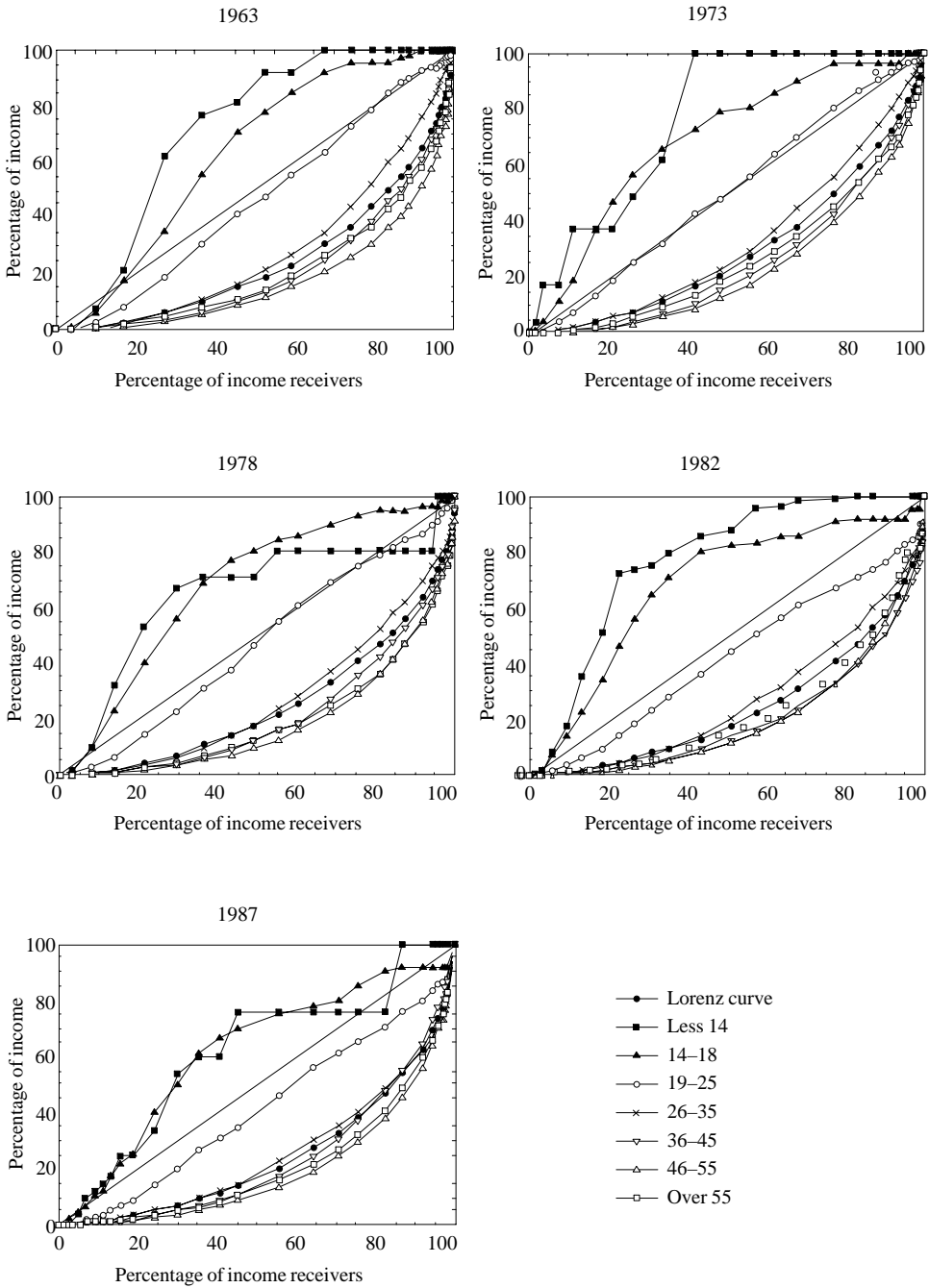
By using these elasticity figures, it is possible to estimate changes in the Gini coefficient, while increasing or decreasing the relative income share of the particular age group. For example, as seen in Table I, the relative income share of the over 55 age group increased from 16 per cent to 19 per cent during the 1963–87 period. If this increase had not happened, in 1987 the total Gini coefficient of the country would have been 0.5132 instead of the actual value of 0.5218 (a 2 per cent decrease from the actual value). However, it must be remembered that these predictions are subject to change with the changing value of the concentration coefficient of the each age group. Since signs of the concentration coefficients did not change, the contribution direction of inequality components remained constant during the whole period.

Finally, the national-level Lorenz curve and concentration curves for the each age group are plotted in Figure 2. Since the income for each age group is arranged under the order of total income, unlike the Lorenz curve, some concentration curves may appear in the upper part of the figure. For example concentration curves for the less than 14 and 14–18 age groups lie above the 45 degree line (egalitarian line) during the whole period. In other words, income is concentrated in relatively low-income groups in these two age groups. In addition, the inequality order of the 35–45 and the over 55 age groups changed during this period. The income inequality associated with the 26–35 age group is less than the total income inequality during the whole period.

VII. CONCLUDING REMARKS

This paper has examined the age of income receivers as a factor determining income inequality in Sri Lanka at the sectoral, regional, and national levels during the 1963–87 period. In terms of the Theil *L* index, age differences in the income receivers (age effect) contributed 12.3 per cent of the total income inequality in 1963. This share increased to 14.8 per cent in 1978. Due to the narrowing mean income gap among different age groups, the contribution of age differences to total income inequality decreased to 8.2 per cent in 1987. However, these large variations in the percentage contribution of the age effect to total income inequality result mainly from large absolute changes in aggregate inequality (ranging from 0.13 to 0.23) in relation to an almost constant absolute age effect (ranging only from 0.02 to 0.03) (see Table II).

Fig. 2. Comparison of the Lorenz Curve and Concentration Curves for Each Age Group, 1963-87



Inequality decomposition by age at the sectoral level led to an understanding of the high contribution of the age effect in the urban sector followed by the rural sector. In 1978 the age effect was as high as 17 per cent of the total income inequality in the urban sector. In addition, in the regional-level decomposition, it was found that the importance of age on total income inequality was positively related with the level of development in the regions. In the more developed regions, age is a more powerful factor in determining income inequality and vice versa.

In order to understand causes behind the large share of the within-age-group income inequality (92 per cent of total income inequality in 1987), inequality associated with each age group was decomposed by location (sector and region) and gender of the income receivers. Although region and gender are not sizable determinants, sectoral differences contributed a significant portion of the income inequality associated with some age groups in certain years. For example, in 1963 18.5 per cent of the income inequality associated with the 26–35 age group was due to sectoral differences in the mean income of the income receivers in that age group.

By decomposing temporal changes of income inequality, attempts were made to find the impact of change in the population structure on total income inequality. Even though the share of the population of the less than 14 and over 55 age groups changed noticeably, the shares of income receivers and the relative incomes associated with these age groups did not significantly change during the 1963–87 period. Therefore, changes in the population share did not have a sizable effect on within-group component during the whole period. However, during the 1978–87 period the changing population shares determine a large part of the change in the between-group component of income inequality.

As seen in the estimated elasticity of the Gini coefficient for different age groups, increasing the relative income share of the under 35 age groups can reduce the total income inequality in Sri Lanka. On the other hand, increasing the relative income shares of the over 35 age groups will lead to an increase in total income inequality. Therefore, the growing number of elderly people makes income distribution less equal in Sri Lanka. As estimated in this paper, during the 1963–87 period a 3 per cent increase in the relative income share of the over 55 age group led to an increase in the overall Gini coefficient of 2 per cent. Since the elderly population will grow at a faster rate in future, the growth rate of inequality will also increase. Therefore appropriate policies must be taken to reduce inequality associated with some population groups. In this context, income receivers in the 36–45, 46–55, and over 55 age groups must be targeted. In particular, sectoral differences in the mean income of these groups must be reduced to provide a long-term solution for the problem of income inequality in Sri Lanka.

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APPENDIX A

I. It is possible to relate equations (5) and (6) as follows:

$$G = \sum_{i=1}^{n-1} \frac{N_i}{N} \cdot \frac{Y_{i+1}}{Y} - \sum_{i=1}^{n-1} \frac{N_{i+1}}{N} \cdot \frac{Y_i}{Y} \quad [\text{Equation (5)}]$$

$$\begin{aligned} &= \sum_{i=1}^{n-1} \frac{N_i}{N} \sum_{k=1}^m \frac{Y_{i+1,k}}{Y} - \sum_{i=1}^{n-1} \frac{N_{i+1}}{N} \sum_{k=1}^m \frac{Y_{i,k}}{Y} \\ &= \sum_{k=1}^m \left(\sum_{i=1}^{n-1} \frac{N_i}{N} \cdot \frac{Y_{i+1,k}}{Y} - \sum_{i=1}^{n-1} \frac{N_{i+1}}{N} \cdot \frac{Y_{i,k}}{Y} \right) \\ &= \sum_{k=1}^m \frac{Y_k}{Y} \cdot \left(\sum_{i=1}^{n-1} \frac{N_i}{N} \cdot \frac{Y_{i+1,k}}{Y_k} - \sum_{i=1}^{n-1} \frac{N_{i+1}}{N} \cdot \frac{Y_{i,k}}{Y_k} \right) \\ &= \sum_{k=1}^m \frac{Y_k}{Y} \cdot C_k \\ &= \sum_{k=1}^m W_k C_k. \end{aligned} \quad [\text{Equation (6)}]$$

where $Y_{i,k}$ = cumulative k -th income (labor income) and Y_k = total k -th income (labor income).

II. Equation (7) can be obtained by taking the total derivative of equation (6) with

respect to the income share of each age group, assuming C_k is constant, and substituting the results in the normal elasticity formula. See Podder (1993, pp. 53–54) for the proof, but we can derive equation (7) in the following way.

$$G = \sum_{k=1}^m W_k C_k. \tag{Equation (6)}$$

Since $W_k = Y_k/Y = \mu_k/\mu$ ($\mu = \text{mean income}$)

$$G = \sum_{k=1}^m (\mu_k/\mu) C_k.$$

Taking up only the k -th population subgroup,

$$G = (\mu_k/\mu) C_k.$$

Then total differentiation with respect to μ_k gives

$$\begin{aligned} dG &= (C_k/\mu) \cdot d\mu_k - (\mu_k/\mu^2) \cdot C_k \cdot (\partial\mu/\partial\mu_k) \cdot d\mu_k \\ &\hspace{15em} (\partial\mu/\partial\mu_k = 1) \\ &= (C_k/\mu) \cdot d\mu_k - (G/\mu) \cdot d\mu_k \\ &= (C_k - G)/\mu \cdot d\mu_k \\ dG/d\mu_k &= (C_k - G)/\mu. \end{aligned}$$

Elasticity formula is

$$\begin{aligned} \eta_k &= \frac{dG}{d\mu} \cdot \frac{\mu_k}{G} = \frac{C_k - G}{\mu} \cdot \frac{\mu_k}{G} = \frac{1}{G} \left[\frac{\mu_k}{\mu} (C_k - G) \right] \\ &= \frac{1}{G} [W_k (C_k - G)]. \tag{Equation (7)} \end{aligned}$$

APPENDIX B

The most important factor associated with the Gini coefficient and the Lorenz curve is that the income data must be in ascending order to obtain practical results. Otherwise income distribution literature renames results as the concentration coefficient and concentration curve. The disaggregation of the Gini coefficient is mostly associated with source income data, which may not be in ascending order. When a specific income source is arranged in the ascending order of the total income and the percentages of that income source are plotted against the percentages of income units, it is possible to obtain the concentration curve for relevant income source. The concentration coefficient can be obtained by dividing the area between the egalitarian line and concentration curve by the total area of the triangle below the egalitarian line. It is possible to obtain the concentration coefficient by replacing a specified income source for Y_i in the Gini coefficient formula. For example, if labor

income is the source of k -th income, we can calculate the concentration coefficient for labor income using the following formula.

$$C_k = \sum_{i=1}^{n-1} N_i YL_{i+1} - \sum_{i=1}^{n-1} N_{i+1} YL_i,$$

where

C_k = concentration coefficient for k -th income (labor income),

$Y_{i,k}$ = cumulative k -th income (labor income),

Y_k = total k -th income (labor income),

$Y_{i,k}/Y_k$ = cumulative proportion of k -th income (labor income).

Since the specified income source is in the ascending order of the total income, the concentration coefficient for that income source unlike the Gini coefficient can have either a positive or negative value. Furthermore, unlike the Lorenz curve, the concentration curve can exceed the egalitarian line due to the above reason.