

# **Trade and Income Inequality in SAARC: A Spatial Analysis**

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## *Abstract*

This paper aims to study the spatial dependency of trade and per capita income among the countries of SAARC. Here, both trade and income inequality has been estimated for the SAARC countries over the years 1989 to 2003 using Theil's index and has been decomposed indicating the least developed countries (LDCs) and non-LDCs of the region. It has been seen that the within group inequality dominates the between group inequality for both the cases. And the output of polarization index has pointed the change of within group inequality for the year 1995. In this analysis, spatial autocorrelation has also been measured and compared with the inequality pattern. For income negative and for trade strong positive spatial autocorrelation has observed, but in some particular years data has shown no spatial dependency for both the variables.

**JEL Classifications:** C21, D63, F1, N75, O53, R12

**Keywords:** Inequality, Theil's index, Polarization index, Spatial autocorrelation, Moran's I.

## **1. Introduction**

Inequality analysis with its important political bearings, has attracted much attention in the past in the economic literature. Starting from the seminal work of Kuznets (1955), in the literature there is some empirical evidence that economies with unequal distribution of income grow faster than those with an even income distribution. Barro (2000) argues in this direction, but empirically found little overall relation between income inequality on one side and growth rates and investment on the other. The debate, thus, seems still open. In this paper, per capita income and trade pattern has been studied for the countries of SAARC (South Asian Association for Regional Cooperation) region. SAARC was established on December 8, 1985 by the Heads of State or Government of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Recently Afghanistan has entered as a member of this SAARC. It provides a platform for the peoples of South Asia to work together in a spirit of friendship, trust and understanding. It aims to accelerate the process of economic and social development in Member States. It has been observed that, during the period 1980-2000, two of the economies (India and Bangladesh) increased their GDP growth rates by roughly 2 percentage points per annum relative to the rates they had sustained in the two decades prior to 1980. Sri Lanka's growth increased only marginally, but from the initially strong rate of 4.5 percent per year. And while average output growth declined after 1980 in Pakistan, it remained about 5 per cent per year. Growth rates of these magnitudes are impressive achievements that have helped these countries to reduce poverty rates and raise living standards. Indeed, South Asia grew more rapidly than any other region except East Asia (Bosworth and Collins, 2003).

The inability of the World Trade Organization (WTO) to broker a multilateral trading system acceptable to all its members has sparked a rising interest in regionalism. The first wave of regionalism in the 1960s was divided along North-North and South-South trading arrangements. In the 1980s, the second regionalism wave evolved into a North-South trading arrangement. However, in a post-Cold War setting, regional groupings have responded to the volatility of the multilateral trading system by increasing regional cooperation and trade and various trade-driven groupings emerged such as the North American Free Trade Area (NAFTA), Asia-Pacific Economic Cooperation (APEC), Association of South- East Asian Nations (ASEAN), and South Asian Association for Regional Cooperation (SAARC).

Theil (1996) applied a de-compositional analysis to 100 countries over 1950-90 and found that the majority (roughly 88%) of global inequality was due to differences between, rather than within, regional groupings of countries. In a similar study, Levy and Chowdhury (1995) report that, the relative importance of the two components has varied over the 1960-90 period, with the between region component dominating from 1960-67, the within region component being larger from 1967-83, and a second reversal from 1983-90. Fan and Casetti (1994) analyzed U.S. state income inequality using four Census Divisions to define the partitions. Using the same partitioning, but county rather than state data, Conceicao and Ferreira (2000) conclude that the within component of inequality was the most important share over the 1969-96 period.

Geographical decomposition of inequality has been applied at the inter-national as well as intra-national scale. These studies have illuminated the spatial structure underlying the

dynamics of regional inequality in different contexts. However, there is much variation across the studies with respect to the relative importance of inter versus intra regional inequality components. What is currently unknown, however, is to what extent that variation is due to differences in the structure of the economies in the different studies or to the articulation of methodological issues across the studies. These issues include the choice of regional partitioning and the spatial scale of the observational units.

## **2. Inequality Analysis and Polarization**

There are quite a number of inequality indices exists (Cowell, 1995). A popular choice is Theil's inequality measure (Theil, 1967), which is defined as;

$$T = \frac{1}{n} \sum_i \left( \frac{y_i}{\bar{y}} \ln \frac{y_i}{\bar{y}} \right)$$

In this study,  $n$  is the number of countries in the region SAARC,  $y_i$  is the per capita income or trade of country  $i$ , and  $\bar{y}$  is the mean income or trade of the region.

$T$  is bounded on the interval  $[0, \log(n)]$ , with zero reflecting perfect equality and a value of  $\log(n)$  occurring when all the income is concentrated in one country of the region. As  $T$  is a member of a generalized entropy class of inequality measures it has the quality of being additively decomposable. In studies of inequality, the de-compositional property has been exploited to investigate the extent to which global inequality is attributable to inequality “between” or “within” regional groupings. In this analysis,  $T$  has been decomposed as follows;

$$T = \sum_{k=1}^m s_k T_k + \sum_{k=1}^m s_k \ln \frac{\bar{y}_k}{\bar{y}}$$

Where,  $m$  is the number of groups in the region,  $s_k$  is the share of group  $k$ ,  $T_k$  is the Theil's index for that sub-group, and  $\bar{y}_k$  is the average income in group  $k$ .

The first term on the right hand side of the de-compositional index is the “within-group” component of inequality, while the second term is the “between-group” component of inequality. In other words;

$$T = T_w + T_B$$

From this decomposition of inequality, recently, Zhang and Kanbur (2001) have suggested an index named polarization index. The index is defined and denoted as;

$$P = \frac{T_B}{T_w}$$

### 3. Spatial Dependency and Inequality Analysis

Spatial autocorrelation or dependency means the value at any one point in space is dependent on values at the surrounding points. That is, the arrangement of values is not random. Arguably the best-known test statistic against spatial autocorrelation is the application of Moran's I statistic for spatial autocorrelation (Moran 1948). It is defined as;

$$I = \frac{n}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j (y_i - \bar{y})(y_j - \bar{y})}{\sum_i (y_i - \bar{y})^2}$$

where,  $w_{ij}$  is the spatial weighted matrix with elements taking on the value of 1 if states  $i$  and  $j$  are first order neighbors (i.e., share a border), 0 otherwise. Here,  $y_i$  is the per capita income and trade in the country  $i$  and  $\bar{y}$  is the average of the values.

Similar to correlation coefficient, it varies between  $-1.0$  and  $+1.0$ . When autocorrelation is high, the coefficient is high. A high  $I$  value indicates positive autocorrelation. Moran's  $I$  (Moran 1950) is a weighted correlation coefficient used to detect departures from spatial randomness. Departures from randomness indicate spatial patterns, such as clusters. The statistic may identify other kinds of pattern such as geographic trend. Moran's  $I$  tests for global spatial autocorrelation in group-level data.

For Moran's  $I$ , positive spatial autocorrelation means, nearby areas have similar rates indicating global spatial clustering. Nearby areas have similar rates when their populations and exposures are alike. When rates in nearby areas are similar, Moran's  $I$  will be large and positive. When rates are dissimilar, Moran's  $I$  will be negative. That is, positive spatial correlation means similar values tend to be near each other and negative spatial correlation means different values tend to be near each other. Using the values, a normalized value for  $I$ , called  $Z(I)$  can be calculated. As usual, the null hypothesis is that there is no spatial autocorrelation.

#### **4. Analysis of the Data**

In this study the primary interest is to check the regional income distribution and the trade pattern of the SAARC region. The analysis solely focused on the inter-country development of the SAARC region. Data has been used in this study, collected from the world development indicator (WDI) database (World Bank 2005) for years 1989 to 2003.

In this paper, countries of the SAARC region have been divided accordingly two groups one LDCs (least developed countries) and other non-LDCs. United Nations (UN) has listed 50 countries as LDCs. Bangladesh, Bhutan and Nepal are among the LDCs of the SAARC region. This study has created the desired strata of LDC in SAARC by marking them as '1' and the other countries as '0'. So our analysis has been focused on LDCs improvement comparison with the non-LDC countries in SAARC.

#### **4.1 Inequality Analysis in the SAARC**

To see the inequality pattern in SAARC, Theil's index has been used for both the variables per capita income and the trade. It has been observed that the correlation between income and trade is -0.81; which is negative and high. Again, it has been seen from the figure 1 that the overall trade inequality is decreasing whereas the overall inequality for the per capita income is increasing. It has also been observed that for trade there is a sudden downward shift in inequality in the year 1993 and Theil's value has calculated as 0.12927, whereas in the year it was 0.16733. After the year 1992 it has been see that there is no increase in the inequality for trade of the countries of the SAARC.

Again if the figure is closely observed for per capita income, it has been seen that the income inequality is increasing year by year. Though it has been observed a little

improvement in inequality in the year 2001, but after wards the inequality again has taken its increasing pattern. It has also been seen that after year 2001, income inequality has exceeded the trade inequality; where as, in the previous years income inequality was less than the trade inequality.

So from this analysis, it has been seen that there are some terminal years where, inequality shapes its new pattern. These years are 1990, 1992 and 2000 for trade and 1991 and 2001 for per capita income. That is, averagely the early years of 90s and 00s the inequality pattern turns to a new shape.

**Please Insert Figure 1 Here**

In this paper, polarization index has been calculated by decomposing the Theil's inequality index. It has been seen from figure 2 that the polarization curve of the per capita income of LDCs and non-LDCs of the SAARC region has exceeded 1 in the years 1995 and 1996, and there has been occurred a sudden increase in the index after the year 1994 and a sudden decrease in the year 1997, though it has been observed that the values of Theil's inequalities are very low for both the cases analyzed.

From this part, it can be concluded that except the years 1995 and 1996 the within group inequality shown a dominant role over the between group inequality. So, it has exhibited that, relatively small difference has occurred between the LDCs and non-LDCs of the SAARC countries for per capita income.

**Please Insert Figure 2 Here**

Again, from figure 3 it has been observed that the polarization curve for trade has not exceeded the unity and the highest value has been occurred in 1998 which is calculated as 0.047763. However, the within inequality is higher than between inequality of the LDCs and non-LDCs groups. And the within groups inequality has a decreasing pattern over time. The polarization has upwards shifts in the years 1992, 1995, 1998 and 2001.

It has also been seen from the figure that, the within group inequality has its dominance over the between group inequality. And specifically saying there is very low inequality exhibits for the between groups. Similar to the per capita income, this result has also been established that for trade, the within group inequality is very large in the SAARC region.

**Please Insert Figure 3 Here**

#### **4.2 Inequality and Spatial Dependence**

In this analysis, spatial autocorrelation has been calculated using Moran's I. It has been observed from figure 4 that; for the year 1995, there is a low and positive spatial autocorrelation exists in the region which has calculated as 0.059. The strong negative spatial autocorrelation has been noticed for the year 1989, which is 0.46. And for the years 1995, 1996, and 1998 there also exists a low positive spatial autocorrelation in the region, though relatively high inequality have been exhibited in those years. It has been observed that in the year 1991 both the spatial negative autocorrelation and income inequality have

been decreased correspondingly compare to the previous years, though the overall inequality of income has been exhibited an increasing pattern over the time.

From the figure 4, it has also been seen that most of the values for Moran's I is negative. So, there is a negative spatial autocorrelation exists in the region for per capita income. This negative spatial dependency illustrates that the nearby per capita income is dissimilar in the region and a high negative observation indicates the different values of per capita income tend to be near each other. So, it has been seen that for the years 1989 and 1990 the dependency was very high and that time the different income levels of different countries of SAARC tend to be near each other.

**Please Insert Figure 4 Here**

In this study, spatial dependence for trade has also been observed for the SAARC regions. It has been seen from the figure 5 that, for the year 1992 trade inequality was highest, and after wards the inequality has been decreased over time. It has also been seen that the spatial autocorrelation for all the time period is positive for trade. The highest spatial autocorrelation has been occurred in the year 1990 which is 0.236, after this year the spatial autocorrelation has shown a decreasing pattern over the time up to 1997 and exhibited the lowest spatial autocorrelation. After 1997 the spatial autocorrelation has again been increased for the following years. In the year 2003 the spatial autocorrelation has been calculated as 0.137 however the inequality is relatively low in that year.

From the figure 4, it has also been seen that, the overall trade inequality is decreasing and the spatial dependency is dissimilar for different years. If rough it can be said that from 1997 to 2001 there is no spatial dependency for trade in the region. But for some other years they have spatial positive dependency. It indicates that after a gap recently spatial autocorrelation has its positive effect on trade; i.e., the similar trade values of the SAARC countries tend to be near each other, which explain a significant spatial trade effect.

**Please Insert Figure 5 Here**

## **5. Conclusion**

This study has been used the data of per capita income and trade from 1989 to 2003 to see the inequality pattern and spatial dependency of the countries of SAARC. It has been seen that the within group inequality in LDC and non-LDC countries of SAARC is higher than the between group inequality for both the variables studied. It indicates that there is actually no difference between the LDC and non-LDC countries of the region. It has been observed that the within group inequality is maximum in the year 1989, which is 80 per cent of the total inequality. Again for trade the percentage of between group inequalities is very low and negligible. Here the within group inequality has dominated for all the years studied in this analysis. It has been observed from the analysis that for both the per capita income and trade polarization has its effect at mid and after 90's.

Comparing the spatial dependency of the LDCs and non-LDCs, it has been seen that for per capita income, Moran's I has negative values for most of the years analyzed. The

years 1995, 1996 and 1998 have positive but approximately zero autocorrelations. Here negative dependency dominated in the region for per capita income. And for trade the positive dependency has dominated over the region. Thus, for negative spatial autocorrelation it indicated that the nearby incomes are dissimilar in the region and different values of income tend to close to each other, and for positive spatial autocorrelation it indicated that the nearby similar trades values are tend to close to each other.

Finally, from this analysis we can conclude that the income inequality is increasing over time and trade inequality is decreasing. So there is a negative correlation between the trade and income inequality. Besides the within group inequality is high compare to the between group inequality for both income and trade of the LDC and non-LDC countries. And the spatial dependency is negative for income and positive for trade of the countries of the SAARC region.

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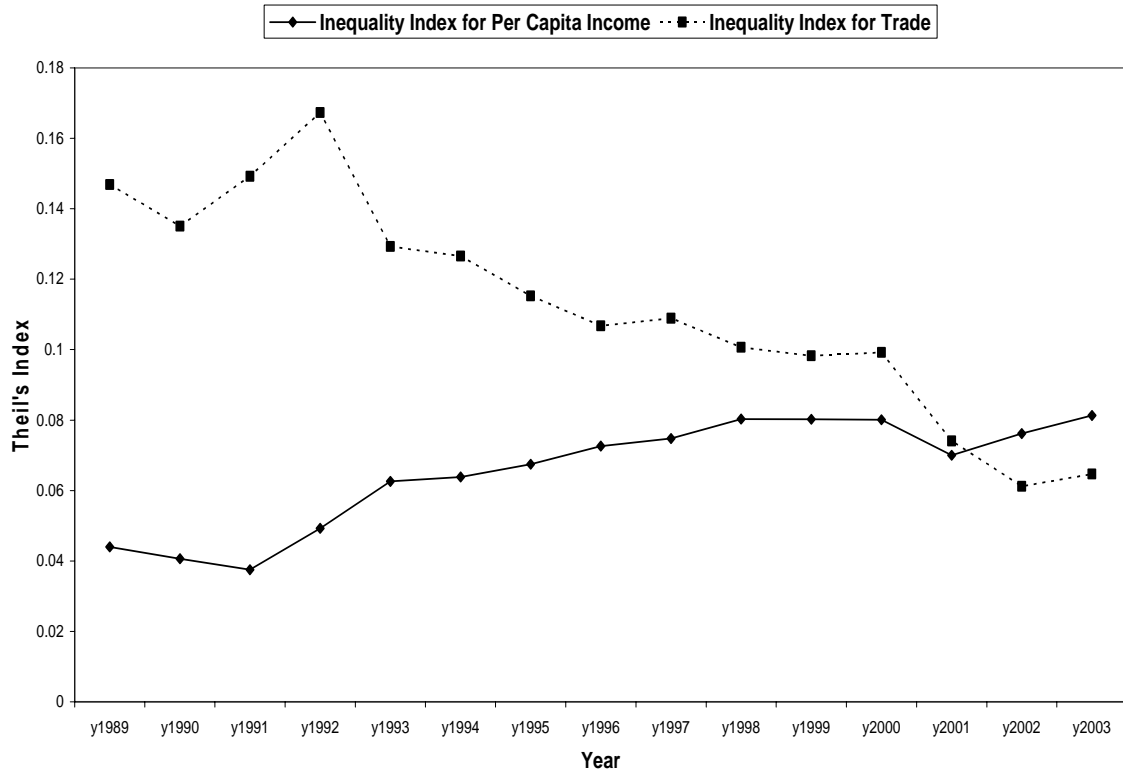


Figure 1: Inequality Pattern for Per capita Income and Trade in the SAARC region.

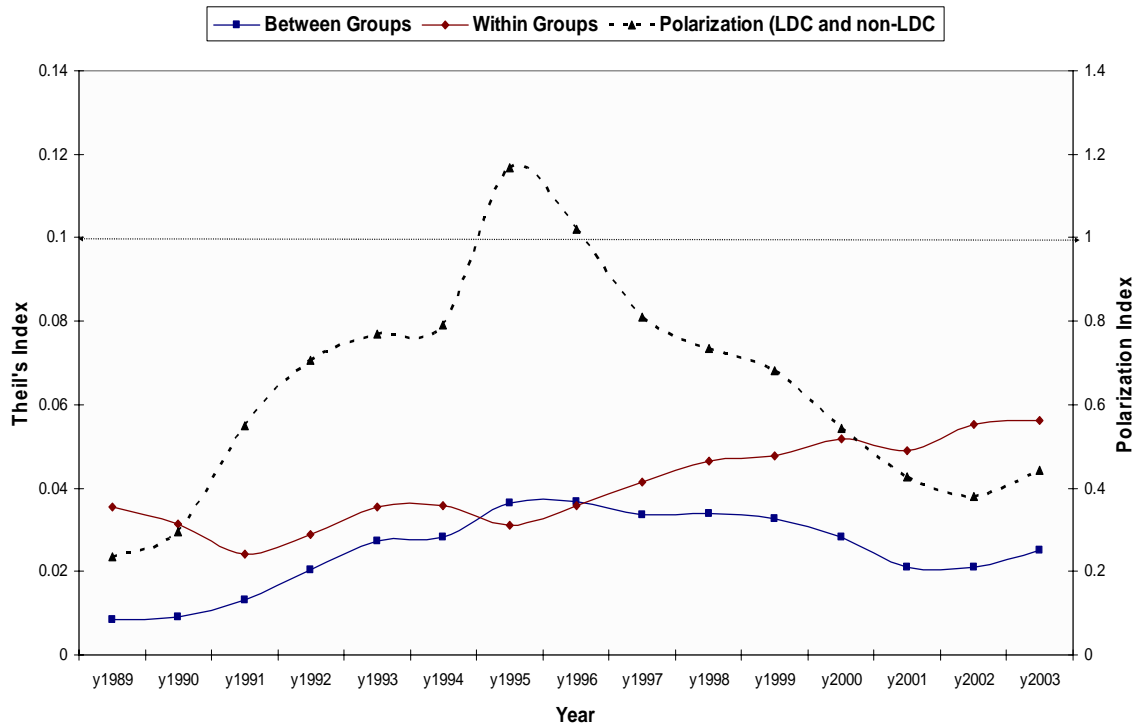


Figure 2: Theil's and Polarization Index of Per capita Income for LDCs & non-LDCs Countries of the SAARC region.

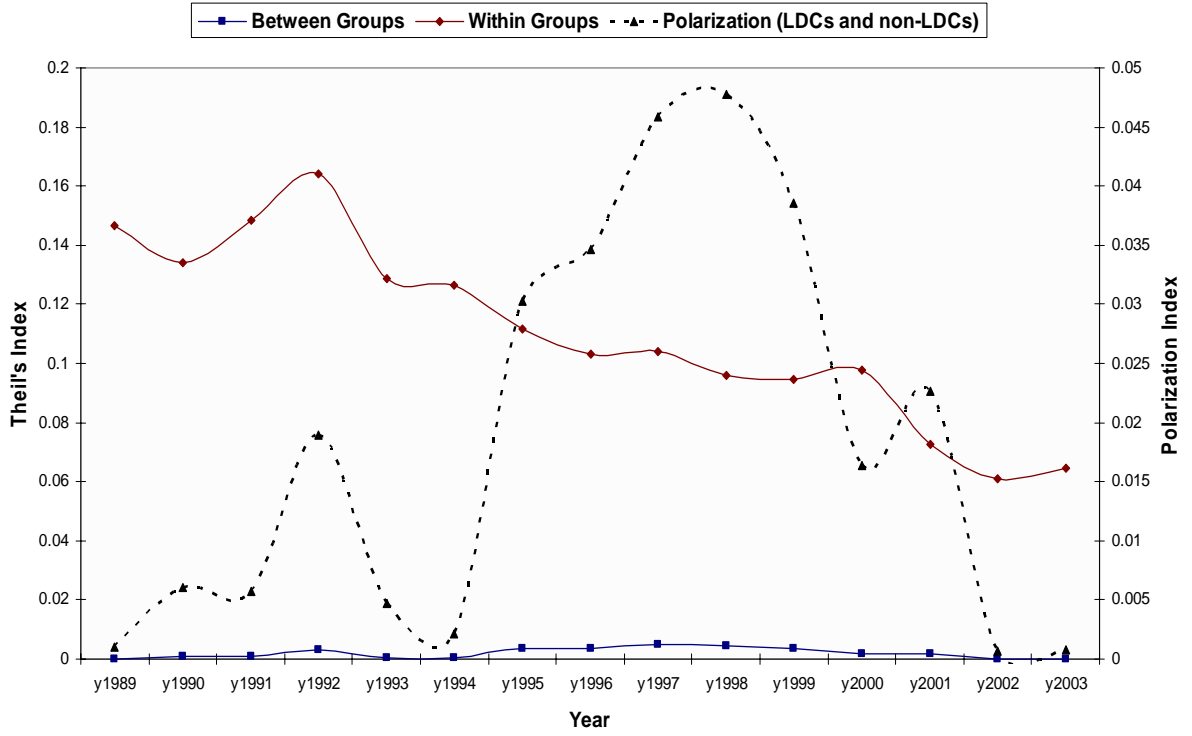


Figure 3: Theil's and Polarization Index of Trade for LDCs & non-LDCs Countries of the SAARC region.

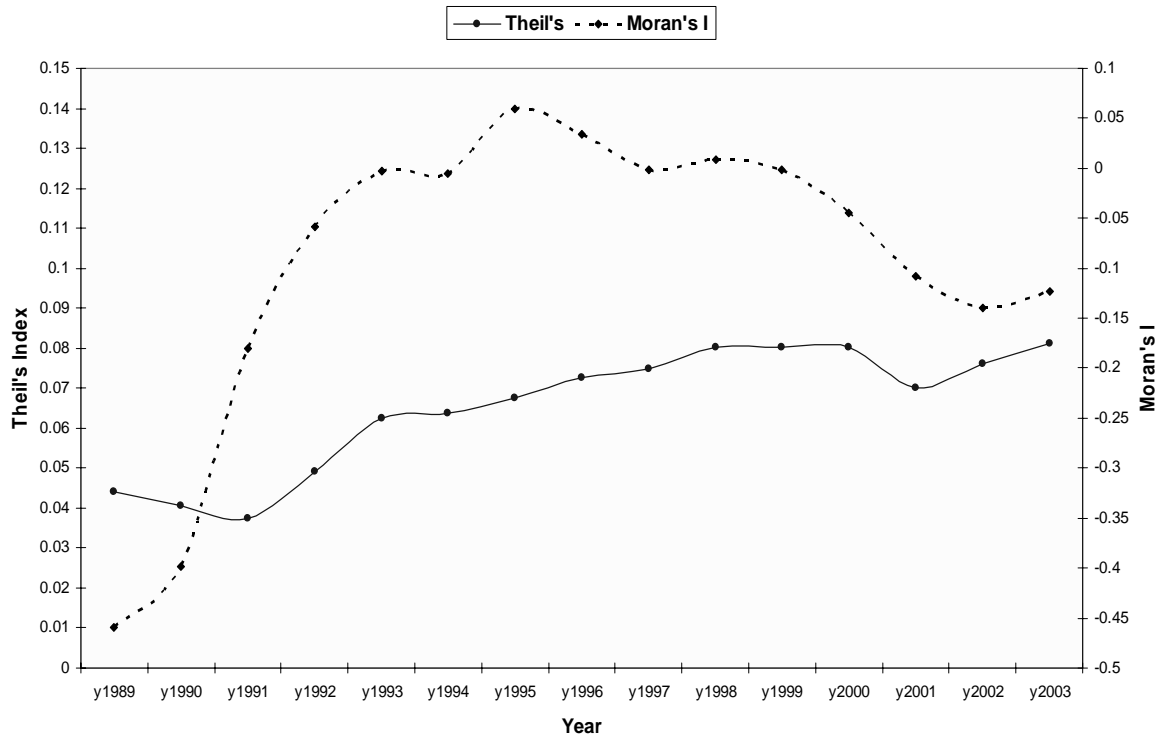


Figure 4: Inequality and Spatial Dependence Pattern for Per capita Income of the SAARC region.

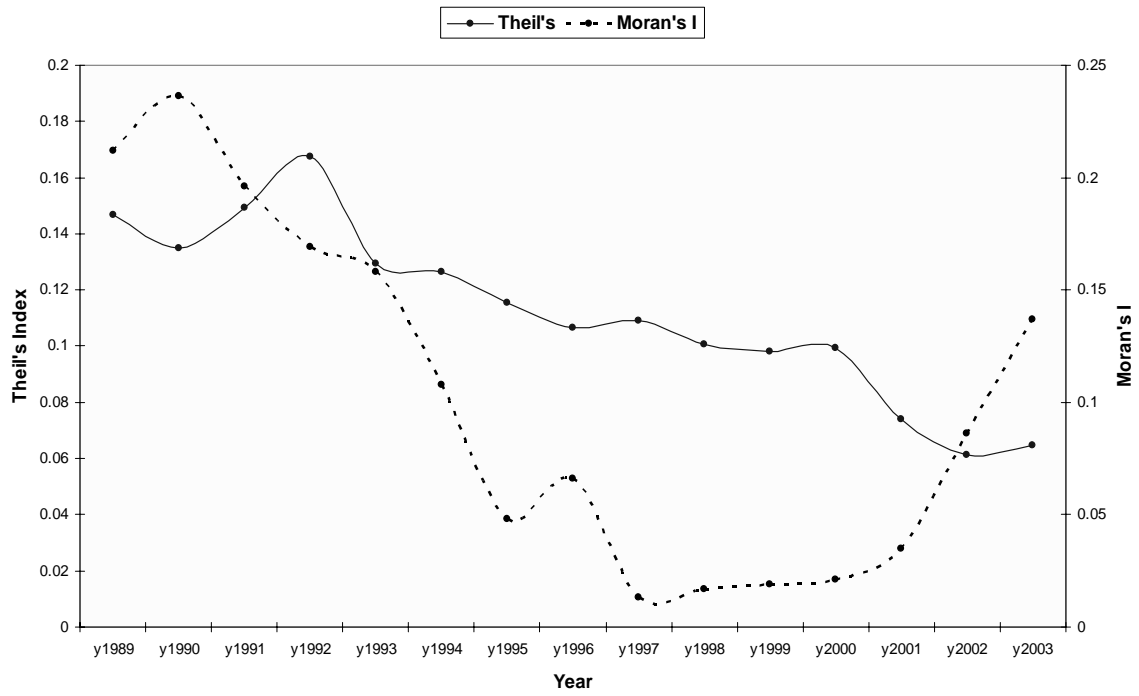


Figure 5: Inequality and Spatial Dependence Pattern for Trade of the SAARC region.