

Is Export Expansion of Manufactured Goods an Escape Route from Terms of Trade Deterioration of Developing Countries?

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Shouvik Chakraborty

Abstract

In the recent past, the developing countries, in particular the Newly Industrialising Countries (NICs), Association of Southeast Asian Nations (ASEAN), China and India, have become a major player in the global market of manufactured goods. It had been argued that this changing composition in the export baskets of these developing countries in favour of the manufactured goods had helped the developing countries to escape from the problems of 'deteriorating' terms of trade and doubts the validity of the Prebisch–Singer hypothesis in the present world economic order. This study empirically finds a secular negative trend in the movement of the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed countries spanning over the period between 1975 and 2005. It also identifies the probable factors responsible for this negative trend in the terms of trade index and whether this diversification of exports towards more of manufactured goods helps the developing countries to escape from the problem of Prebisch–Singer hypothesis.

Keywords

Terms of trade, Prebisch–Singer Hypothesis, manufactured exports, export diversification, industrialisation, specialisation, deterioration hypothesis

Introduction

The impetus of the industrialisation strategy in the post–World War II phase of the developing countries got its theoretical support from Prebisch (1950, 1959 and 1964) and Singer (1950, 1975 and 1982). As noted by Bagchi (2008: 23):

Shouvik Chakraborty, Visiting Fellow, Political Economy Research Institute (PERI), University of Massachusetts. Email: shouvik@peri.umass.edu

... the imperially imposed division of labour under which the underdeveloped countries were to specialize in agricultural commodities with low income elasticities of demand had to be overtuned and a vigorous programme of industrialization had to be taken in hand if the poverty of these newly independent nations was to be seriously dented. The Prebisch-Singer thesis that the terms of trade of primary commodities vis-à-vis the industrialized nations had been on a downward trend for most of the twentieth century added vigour to the industrialiser's argument.

The general policy prescription from the Prebisch–Singer hypothesis was that the developing countries must diversify their exports into manufactures as intensively and rapidly as possible. This the authors believed to be an 'escape route' from the secular decline in the terms of trade of primary commodities vis-à-vis manufactured goods, which would eventually lead to an improvement in the gains from trade of the developing countries.¹

By their following an industrialisation policy since the 1950s, the product composition of the export basket of the developing countries has undergone a major change in the direction of dominance by manufactures from the mid-1970s. Figure-1(a) shows the share of manufactured goods (SITC five to eight less 68) in the total export basket (SITC zero to nine) of the developing countries from 1955 to 2002. The share of manufactured goods in the developing country's total export basket increased sharply from 8.31 per cent in 1955 to 65.37 per cent in 2002. Figure-1(b) shows the share of the developing countries in the total world trade of manufactured goods. The ratio of the developing country's export of manufactured goods in the total world export of manufactured goods increased from 5 per cent in 1955 to 28.1 per cent in 2002. From the figures, it is evident that the share

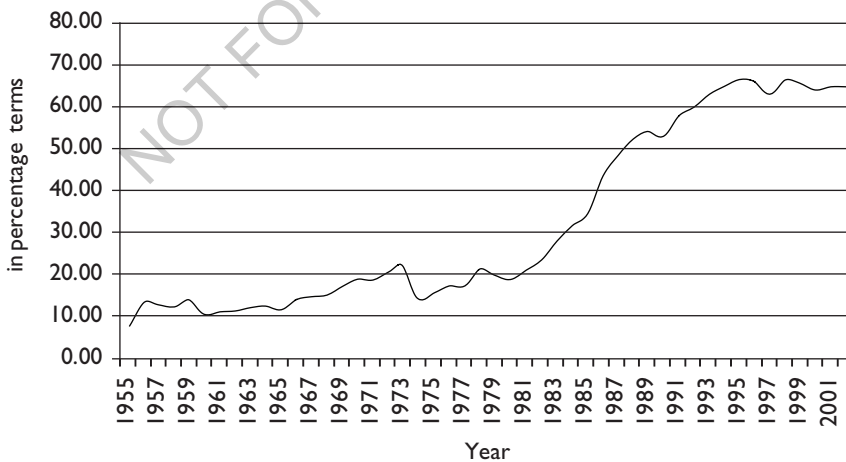


Figure 1 (a). Share of Manufactured Goods in the Total Export Basket of Developing Countries (1955 to 2002)

Source: UNCTAD Handbook of Statistics, various issues.

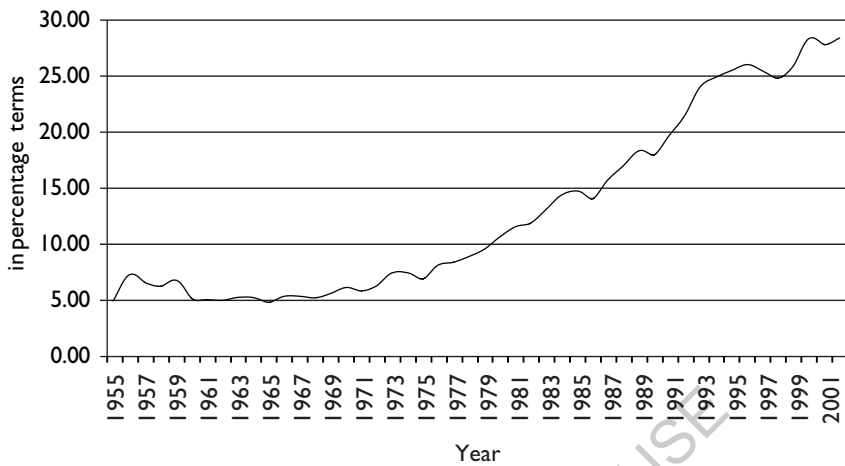


Figure 1 (b). Share of Developing Country in Total World Export of Manufactured Goods (1955 to 2002)

Source: UNCTAD Handbook of Statistics, various issues.

of the developing countries in the world trade of manufactured goods remained negligible during the initial two decades of 1950s and 1960s; thereafter, especially since the mid-1970s, these countries have become a major player in the world trade of manufactured goods. These statistical figures shifted the focus of the debate from primary commodity-manufacture terms of trade to manufacture-manufacture terms of trade between the developing countries and the developed countries in the trade and development literature.

Nevertheless, this does not imply that the traditional concern with the secular decline in the terms of trade of primary commodities vis-à-vis manufactured goods can now be ignored. This is primarily because though the exports of manufactured goods from the developing countries have increased steadily, the expansion has been confined to a few countries only. Amongst the developing countries, the four NICs of East Asia (Hong Kong, South Korea, Singapore and Taiwan) together with the ASEAN-4 (Indonesia, Philippines, Malaysia and Thailand) and China accounted for almost 80 per cent of the increase in the value of exports by all developing countries (including China) from 1980 to 1990.² If India, Brazil, Pakistan, Turkey and the former Yugoslavia are considered, then the proportion rises to almost 90 per cent. Even considering the latest period from 2002 to 2006, the average ratio of the former is almost 77 per cent and of the latter 85 per cent.³ This signifies that the majority of the developing countries are still dependent on the revenue from their primary commodity exports for the bulk of their foreign exchange earnings. Thus, from the majority of the developing country's development perspective, the issue of the terms of trade between primary commodities and manufactured goods still remains a crucial one.

Nonetheless, with a shift in the trading pattern in favour of the manufactured goods in some of the developing country's export basket, the terms of trade issue between manufactured goods of the developing countries vis-à-vis those of the developed countries emerges as an important area of research in the trade and development literature. The focus of the debate shifts from the commodity-manufacture terms of trade to the manufacture-manufacture terms of trade. Though there is a significant and huge volume of literature, both theoretical and empirical, on the issue of commodity-commodity terms of trade, that is, the original Prebisch-Singer hypothesis, previous research has given relatively less importance to the issue of the manufacture-manufacture terms of trade between the centre and the periphery, which, in totality, would have also reflected the issue of the 'country-terms of trade'. The present article is an attempt to test the hypothesis of the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed nations using more recent statistics available and thereby also to find out a plausible explanation for the observed movements.

A Review of the Literature

The research on the terms of trade of manufactured goods between the developing countries and developed countries was mainly initiated in the late 1970s and early 1980s—the period which also coincided with some of the developing countries gaining strength in the world manufacture trade. Keesing (1979) initiated the debate by comparing the unit value indices for the manufactured exports of developing countries and developed countries for a period from 1960 to 1976. He observed a large drop in the developing country's price index in 1975 and attributed this large drop to the inclusion of non-ferrous metal, whose prices showed a great variation from the movement of the manufactured goods' prices in general. However, the second part of his study focusing on the disaggregated wholesale price indices of manufactured goods in the United States shows a declining trend for textiles, clothing, electronics and other labour-intensive goods of the developing countries relative to the prices of other manufactured goods.

In an influential study, Sarkar and Singer (1991) initiated the empirical-based debate on the terms of trade of manufactured goods between developing and developed countries. After fitting an exponential trend equation on the net barter terms of trade over the period 1970 to 1987, Sarkar and Singer (1991: 335) observed that:

... in both US dollars and SDRs, the unit values of manufactured exports of the periphery declined by about 1 percent per annum in relation to those of the centre. Over the period of 18 years, 1970 to 1987, there was a cumulative decline of 20%.

However, given the high growth in the volume of exports of manufactured goods from the developing countries, the income terms of trade increased by 10 per cent

per annum in favour of the developing countries. Observing that the average rate of growth of labour productivity of the manufacturing sector in developing countries declined much more steeply from 2.3 per cent in 1960–70 to 0.4 per cent in 1970–80 (in comparison to the developed countries labour productivity, which declined from 4.1 per cent to 2.3 per cent),⁴ the authors concluded that the double factorial terms of trade deteriorated even more than the net barter terms of trade. The second part of their study analysed the annual trend growth rates of the manufacture-manufacture terms of trade of the individual developing countries vis-à-vis the rest of the world and the ‘centre of the centre’, that is, the USA. The authors observed that the result in their sample of 28 developing countries and one region over the period 1965–85 was neutral in the context of the rest of the world. The results were not statistically significant for about half the countries, while for the remaining half some had a positive trend and the others negative. But for the terms of trade vis-à-vis the United States, that is, the ‘centre of the centre’, very few developing countries showed a significant improvement in their dealing with the United States. Even some countries which showed an improvement in their terms of trade with the rest of the world, demonstrated a negative trend in their terms of trade relations with the United States.

This article was profoundly criticised by Athukorala (1993). There were mainly six points of criticism in response to the Sarkar–Singer (1991) paper. First, Athukorala pointed out that the endpoint of the study period chosen by the authors coincided with the debt crisis and real devaluation of the currencies of developing countries. Bleaney (1993) also supported this criticism. Second, Athukorala questioned the choice of unit value indices to calculate the terms of trade of the manufactured goods between developing and developed countries and pointed out the limitations of this unit value index. Third, Athukorala argued that the aggregate United Nations export unit value indices of manufactures for both the developing and the developed countries relate to the total exports rather than inter-group exports of these two country groups. The industrialised countries manufactured exports have a high proportion of intra-regional trade (almost 80 per cent), whereas the developing countries intra-regional trade in manufactured goods exports are merely 25 per cent. According to him, even the commodity composition of the traded manufactured goods appears to be starkly different between the intra-regional trade and developed-developing country trade. Hence, the United Nations export unit value indices fail to capture the true picture of inter-country trade between the developed and developing nations. Fourth and most importantly, the author argued that the inclusion of non-ferrous metals (SITC-68) as a part of the definition of manufactured goods exports (SITC-5 to 8) of the developing countries affected the price index of developing countries. This might have created a bias in the ‘declining-trend hypothesis’ of the manufacture-manufacture terms of trade since the net barter terms of trade of non-ferrous metals vis-à-vis the industrialised countries showed a statistically significant negative trend. Fifth, in the country-wise analysis of the terms of trade index, the author highlighted the problem of aggregation bias. Sixth, in calculating the double factorial terms of trade

index, the use of labour productivity index of the manufactured goods sector instead of the export-oriented manufactured goods sector also invited criticism from the author.

In their response to the abovementioned criticisms put forward by Athukorala (1993), Sarkar and Singer (1993) tried to provide some counterarguments in defence of their thesis. Responding to the first criticism of the choice of endpoints, Sarkar and Singer (1993) tested whether the declining hypothesis holds for an extended study period from 1970 to 1989 and found that the results did not differ due to the choice of endpoints as the average rate of decline was 1 per cent per annum. Regarding the choice of unit value index as an indicator of the price movements, Sarkar and Singer (1993: 1617) pointed out that the choice of this variable does not create a systematic bias in favour of any direction, which Athukorala himself also admitted. On the third argument of high proportion of intra-regional manufactured goods trade among the industrialised nations and a low proportion for the developing countries, Sarkar and Singer argued that this had the potential of creating a bias against the deterioration hypothesis. Although Athukorala emphasised that this will create a bias in favour of the declining trend, Sarkar and Singer argued just the opposite—due to the increasing technological gap between the ‘centre’ and the ‘periphery’ and the demonstration effect of the ‘first world manufactured’ goods, the monopoly power of the manufactured exporters of developed countries increased over time. Following the definition of the net barter terms of trade, the denominator of the terms of trade series is likely to underestimate the relative upward movements of the unit values of manufactured exports from the industrialised countries to the developing countries (arising due to this monopoly power). Thus, a bias may be formed against the result of the declining trend. To test the validity of the fourth criticism, namely, the inclusion of non-ferrous metals causing a bias in favour of the negative trends, Sarkar and Singer (1993: 1618) fitted a simple regression equation between the non-ferrous metal share in the total manufactured exports of the developing countries and the annual trend growth rate of the terms of trade of individual developing countries. From the regression results, the authors concluded that the cross-country variations in the rate of change in the terms of trade in manufactures of the individual developing countries cannot be explained by the cross-country variations in the share of non-ferrous metals in the total manufactured exports. Rowthorn (1997) too supported Sarkar–Singer; his study found that in the post-1975 phase, the inclusion of non-ferrous metals made very little difference to the Sarkar–Singer analysis of declining manufacturing-manufacturing terms of trade. In response to the fifth criticism of aggregation bias, Sarkar and Singer cited the study by Lücke (1993). Lücke (1993) analysed the behaviour of the net barter terms of trade of ‘resource-free’ manufactures of 37 developed and developing countries from 1967 to 1987. To capture the impact of the economic development of individual countries on the behaviour of the terms of trade, the author regressed the terms of trade figures on the real

per capita GDP of these individual countries. Lucke (1993: 589) concluded that there was a relative decline in the prices of the manufactured goods exported predominantly by the developing countries, which he explained as 'market entry by developing country implies an expansion of supply as well as intensified competition'. Finally, on the issue of labour productivity of the manufacturing sector as a proxy of the labour productivity of manufactured exports, Sarkar and Singer (1993: 1619) argued that this cannot create any bias on the declining hypothesis since 'differences in the rate of growth of the labour productivity in the total manufacturing sectors of the developing countries and industrialised countries also indicate the actual difference between the rates of growth of labour productivity in the export-oriented manufacturing sectors of the two regions'.

In a later study by Minford, Riley and Nowell (1997), the authors compared the price index of the manufacturing exports of the developing countries with a price index for the combined exports of the services and the hi-tech manufactured goods of the developed countries and excluded non-ferrous metals in the construction of their price index. Over the period 1960 to 1995, the authors found a large although irregular deterioration in the terms of trade index of developing countries vis-à-vis developed ones. There was a large and significant drop in the 1960s, which again is repeated in the 1985 to 1990 phase. The authors blamed the former on the increased volume of exports from the developing countries, and the latter on China's sustained entry into the world trade of manufactured goods.

In a later study by Maizels, Palaskas and Crowe (1998), the authors provided further support for the declining terms of trade of manufactured goods between the developing countries and the developed areas of European Union. Over the time period 1979–94, the authors analysed the unit values of manufactured goods imported by the European Union from the developing countries and of the European Union's exports of manufactures to the developing countries and the findings pointed to a deterioration in the terms of trade of manufactures of the developing countries vis-à-vis the European Union.

Like the study of the terms of trade of the developing countries vis-à-vis the European Union, Maizel's (2000) analysis was based upon a new price series data published by the United State's Bureau of Labour Statistics, whose uniqueness is that it only reflects price changes and is not affected by the quality changes. Maizel's analysis ranges from 1981 to 1996. From their study, the results derived are: (1) the net barter terms of trade of developing countries vis-à-vis the United States declined significantly in the first half of the 1980s and thereafter, have been trendless; (2) the net barter terms of trade of the developed countries vis-à-vis the United States have been trendless in the first half of the 1980s and thereafter experienced a significant improvement. By combining both the results, the overall inference from this analysis was that of a significant deterioration in the terms of trade of manufactured goods of the developing countries vis-à-vis the developed countries.

An Analysis of the Manufacture–Manufacture Terms of Trade

From the review of the literature on the manufacture–manufacture terms of trade, it is apparent that there exists a debate on whether the terms of trade of manufactured goods of the developing countries vis-à-vis the developed countries have actually deteriorated over the years or not. In this section, to address this question an empirical analysis is done to find the trend of the manufacture–manufacture terms of trade over the years. The data source of this analysis is the United Nations' Monthly Bulletin of Statistics, which provides unit value indices of manufactured exports for both regions of market economies, that is, the industrial centre and the developing periphery. The data series has been spliced to the same base year, that is, 1980 = 100.

In the present study, we have used the phrase 'terms of trade' to imply the most widely used concept of the 'Net Barter Terms of Trade'. In their simplest form, the terms of trade for a given country or a nation refer to the relationship between its export and import prices. As per this characterisation, a movement in the terms of trade in favour of a country indicates an increase in the quantity of its imports for a given unit of its exports. The concept so defined is the 'Net Barter Terms of Trade' or 'Commodity Terms of Trade'. However, the present study is aware of the fact that this particular concept of terms of trade, although simple and straightforward, has been often criticised by the various segments of the academia. Among several other criticisms, the main point of criticism is that it ignores one or another of the factors which determine the influence of the terms of trade on the balance of payments, the gains from trade or the income of a country. Consequently, several other definitions of the terms of trade have been suggested which take account of one or more of the factors that are ignored in the NBTT. For instance, the 'Income Terms of Trade' takes account of the volume of trade; the 'Single Factorial Terms of Trade' correct the 'Net Barter Terms of Trade' for changes in the productivity in producing exports; and the 'Double Factorial Terms of Trade' correct the 'Net Barter Terms of Trade' for changes in productivity in producing exports as well as imports.⁵

All these various categories of the terms of trade, and whatever definitions are assigned to them, are basically expressed in the form of an index number and therefore incorporate all the criticisms connected with the construction of an index number. Apart from the usual differences that result from the use of a Laspeyres or Passche formula, the size of the sample of commodities used to compute the import and export price indices affects the results obtained. Second, and more importantly, a price series constructed on a limited number of similar goods during a long period of time omits the inclusion of new goods introduced during the period examined and tends to have a bias in the trend of their movements. As discussed earlier, it is beyond doubt that export and import composition for all countries (the developing countries as well as the developed countries) has

changed in the recent past; no terms of trade index exist in the literature till date, which can capture these changing compositions of the import and export baskets of these countries.⁶

The question arises: if there are so many problems with the construction of a terms of trade index, then how can one even attempt to study the movements in the terms of trade, and thereby conclude something definite about their secular movements? The answer lies in the fact that the widespread concern about the issue of the terms of trade over almost the last few decades is not really attributable to any statistical definition of the terms of trade or some statistical methodology tailored to understand their movements. In the vast literature existing on this subject, the concerns put forward by the economists about the terms of trade movements and their future prospects were really to address a much deeper issue rather than to calculate mere statistical figures—the issue that worries the economists, even of the current generation, is the possibility that the developing countries may have to give out progressively larger amounts of exports in exchange for a given unit of imports. The ‘Net Barter Terms of Trade’ are of interest to them only because certain estimates exist, whereas no appropriate estimates of the other definitions of the terms of trade are available till date. In the present article, we will also follow this definition of the terms of trade, that is, the ‘Net Barter Terms of Trade’ only as a means of approach to analyse whether the developing countries have had to *de facto* sacrifice a higher amount of exports for a given unit of imports from the advanced countries. This important issue cannot be merely confined to the discussions on statistical figures and methodologies. Thus, the use of this narrow definition of the terms of trade will only be a proxy of some estimate to capture the secular trend in the terms of trade of manufactured goods of developing countries vis-à-vis the developed countries. Given these limitations and presuppositions of our article, we discuss briefly the methodology and results of this research work.

The methodology applied to calculate the annual trend growth rates of the manufacture-manufacture terms of trade of developing countries vis-à-vis developed countries is twofold. First, we fit a lowess curve to provide a visual understanding about the manufacture-manufacture terms of trade. Then, based on this visual understanding, a simple regression equation is fitted to find the annual trend growth rate of the terms of trade. A detailed technical discussion of the methodology involved in measuring the trend value of the terms of trade has been provided in Appendix.

Figure 2 shows the lowess curve (bandwidth 0.4) of the manufacture-manufacture terms of trade of developing countries vis-à-vis developed countries. From the figure, it can be seen that this index falls over the period 1975 to 2005. The relative prices exhibit wide fluctuations with abrupt peaks and troughs, and a sharp decline in 1984–85. It can be observed that there is a structural break in the year 1984, when the terms of trade index abruptly drops. This indicates a definite break or shift in the time path of the relative price index.

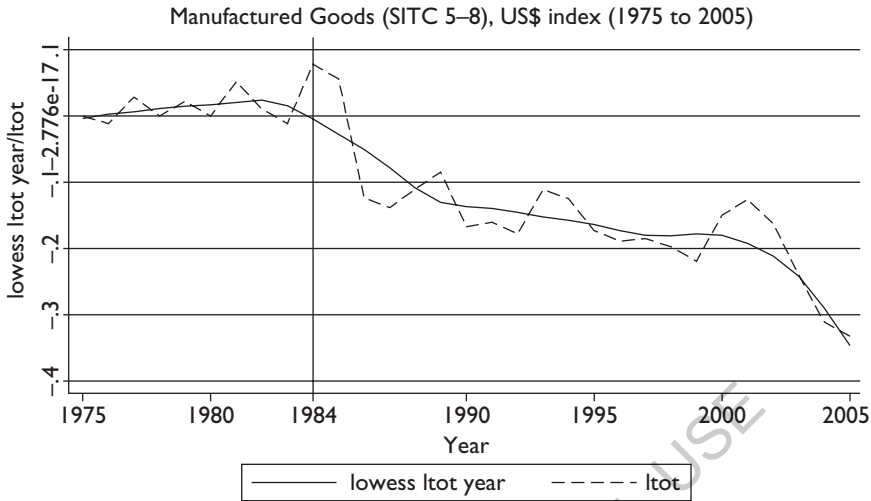


Figure 2. Lowess: ToT of Developing Countries and Developed Countries

Source: Author's calculations.

This structural break in the manufacture–manufacture terms of trade between the developing countries and the developed countries might arise because of two possible factors. First, acceleration in the export of manufactured goods from the developing countries since the mid-1980s can be partially explained by the debt crisis, when the developing countries expanded their manufactured goods exports in an effort to service their burgeoning debt obligations. Second, during that period, the entry of China and East Asia in the world manufacturing market increased the supplies of manufactured goods in the world market, which led to a sharp reduction in the prices of the manufactured goods of the developing countries in that intermediate phase. The fitted lowess curve helps to smoothen the fluctuations and form an idea about the trend of this relative price index.

The results derived from the regression equation are summarised in Table 1. Figure 3 denotes a comparison of the lowess curve and the fitted values of the price index. From the figure, it appears that the fitted line has been able to predict

Table 1. Regression Results of the Manufacture–Manufacture Terms of Trade Index (1975–2005)

Period	Annual Growth Rates	t-statistics	Adj. R ²	F-value	Root-Mean Square Error
1975–1984	0.45%	(0.86)	0.8069	42.79	0.04779
1985–2005	(-)0.96%**	(-2.56)			

Source: Author's calculations.

Note: ** indicates that the results are significant at 95 per cent level of significance.

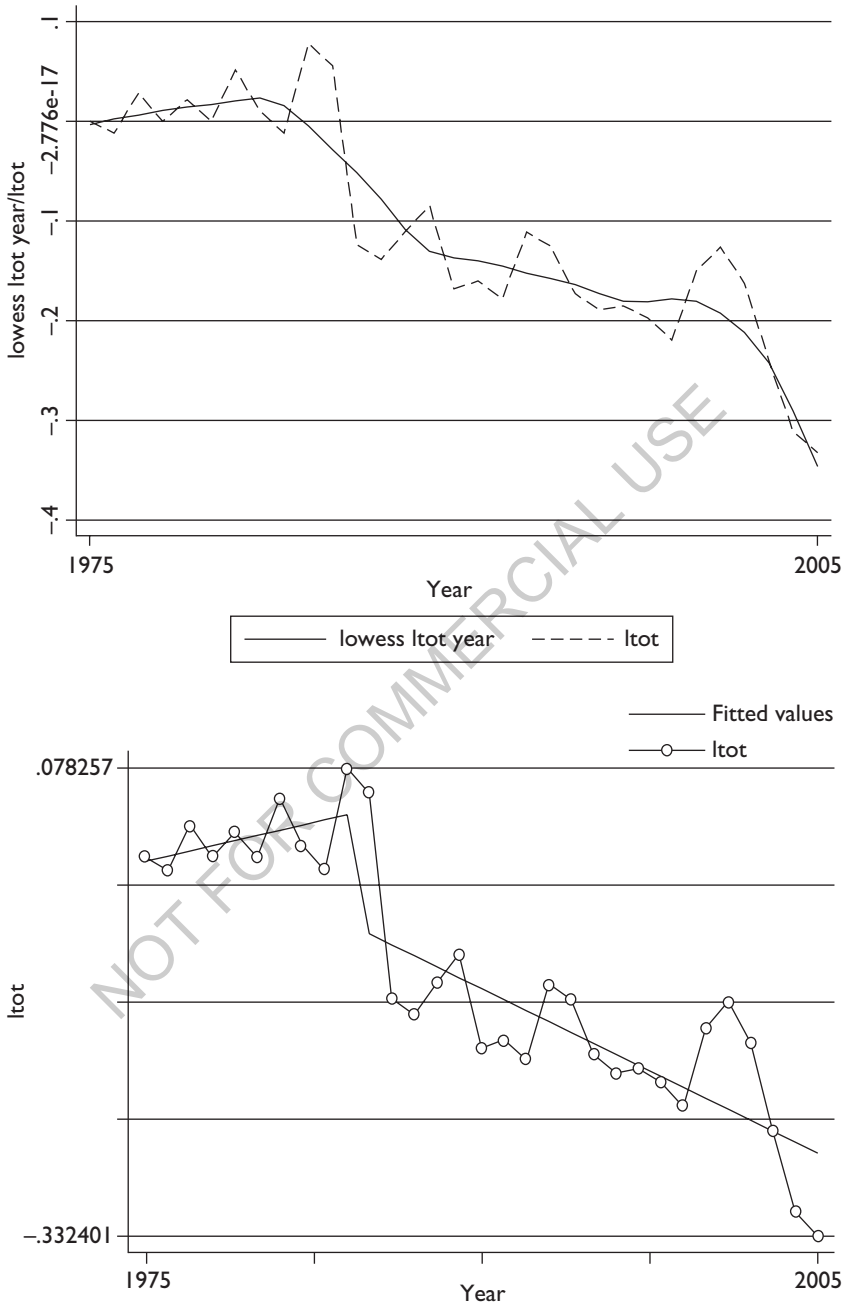


Figure 3. A Comparison of the Lowess Curve and the Fitted Values of the Terms of Trade Index

Source: Author's calculations.

the path of lowess curve of the terms of trade index. The terms of trade index declined at an annual rate of $(-)$ 0.96 per cent per annum over the period 1985–2005. However, during the period 1975–84, there is an annual growth rate of 0.45 per cent. But the result over the period 1975–84 is statistically insignificant. An Augmented Dickey Fuller (ADF) and Phillips–Perron Unit Root test is performed on the residuals of regression equation to test whether the residuals have any time taken. The value of the test statistics is -3.691 and -3.640 , respectively. The MacKinnon approximate p -value for the test statistics is 0.0042 and 0.0091, respectively. Thus, the residuals are independent of any time trend. Hence, the terms of trade index can be well explained by the time variable. Thus, this finding is in conformity with the Sarkar–Singer (1991) analysis of an annual decline of $(-)$ 1 per cent per annum, which is quite close to $(-)$ 0.96 per cent over the period 1985–2005. Therefore, from these findings, one can argue that the developing countries export diversification to manufactured goods did not help them in escaping from the ‘deteriorating hypothesis’.

In the above analysis, the definition of the manufactured goods (SITC 5–8) will invite the same criticism made by Athukorala (1993) against the Sarkar–Singer (1991) results, that is, the inclusion of non-ferrous metals (SITC-68) in the definition of manufactured goods gives a misleading picture. But, in this debate regarding the inclusion of non-ferrous metals in the definition of manufactured goods, Teitel’s (1989) argument seems to be quite relevant. Teitel (1989: 316,337–8) argued:

It seems quite arbitrary that when metalworking processes are applied to iron and steel inputs the results should be considered manufactured products, but when similar processes are effected on non-ferrous metal inputs they should not... The non-ferrous metals case is, in principle, similar to iron and steel and its products; that is to say, various metalworking operations are involved to produce sheet and other flat products, bars and other shapes, tubes and pipes, wires and so on. Obviously, these metal products constitute manufactured products, equivalent, from the point of view of the industrial operations involved, to similar iron and steel products.

Thus, whether non-ferrous metals should be included in the definition of the manufactured goods or not is a debatable issue. However in our analysis, we accept this point of Athukorala (1993) and find out the trend growth rate of the terms of trade index of manufactured goods (excluding non-ferrous metals) of developing countries vis-à-vis developed countries. This is done mainly to find out whether, even after accepting this criticism, the result of declining terms of trade of manufactured goods holds true or not.

Therefore, we calculate the trend growth rate of the manufacture-manufacture (excluding non-ferrous metals) terms of trade of the developing countries vis-à-vis the developed countries. Therefore, a new term of trade index is constructed, following the methodology adopted by Athukorala (1993), to form a relative price index of manufactured goods excluding non-ferrous metals. However, in Athukorala’s calculations, the net barter terms of trade is defined as the ratio of

the unit price index of manufactured goods (SITC 5–8 less 68) of developing countries to the unit price index of manufactured goods (SITC 5–8) of developed countries. Since in the unit price index of the developed countries, the non-ferrous metals are not excluded from the price index of the manufactured goods, it creates an upward bias to the terms of trade index formulated by Athukorala. Hence, to remove this bias from the terms of trade index, we make an adjustment in the data of the unit price index for both the developing countries and also the developed countries. The data adjustment is simply to purge non-ferrous metal prices (unit values) from the reported export unit value index of the developing countries as well as the developed countries.

Suppose,

XPADJ = adjusted export price (unit value) index

ORXP = original (reported) export price (unit value) index

NFMXP = non-ferrous metals export price (unit value) index

NFMXS = the share of non-ferrous metals (SITC 68) in the total manufacturing export (SITC 5–8)

Then the adjusted export price (unit value) index (XPADJ) can be defined as

$$XPADJ = \left[\frac{\{ORXP - (NFMXP * NFMXS)\}}{(1 - NFMXS)} \right] \quad (1)$$

Now, if $(XPADJ)_i$ and $(XPADJ)_{dc}$ denotes the adjusted export price unit value index for the industrialised countries and the developing countries, respectively, then the terms of trade of the manufactured goods (excluding non-ferrous metals) of the developing countries vis-à-vis the developed countries can be denoted as

$$(ToT_{NF})_t = \left\{ \frac{(XPADJ)_{dc}}{(XPADJ)_i} \right\}_t \quad (2)$$

where t denotes the time period over the years 1975 to 2000.⁷

Figure 4 shows the manufacture-manufacture (less non-ferrous metals) terms of trade index of the developing countries vis-à-vis the developed countries over the period 1975–2000 and the corresponding fitted lowess curve. From the figure, it can be seen that this terms of trade index also falls over the study period. Though there are wide fluctuations with abrupt peaks and troughs, the fitted lowess curve helps to smoothen the fluctuations and form a view about the trend of this terms of trade index. Similar to Figure 2, there is a structural break in the year 1984–85, when the terms of trade index abruptly drops, which shows a definite break or shift in the time path of the relative price index.

We apply the same technique of piece-wise semi-log linear regression to calculate the annual growth rate of this terms of trade index. Applying the regression equation, we obtain the results as summarised in Table 2. Figure 5 shows a comparison of the fitted values of the terms of trade with the original lowess curve. From the figure, it appears that the fitted curve is able to capture the movements in the terms of trade index.

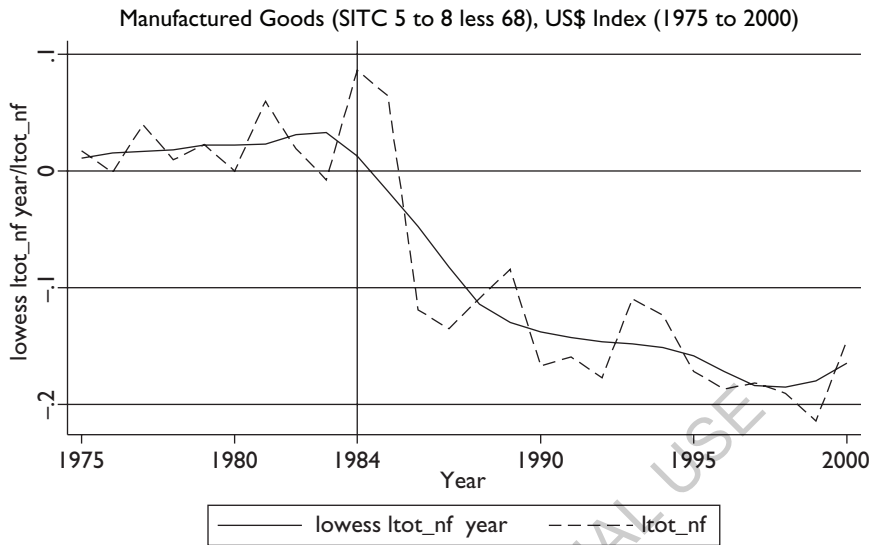


Figure 4. Lowess: ToT of Developing Countries and Developed Countries

Source: Author's calculations.

Even after excluding the non-ferrous metals (SITC-68) from the manufactured goods (SITC 5 to 8) terms of trade index, the annual trend growth rate declines by $(-0.91$ per cent per annum over the period 1985–2000. The annual trend growth rate over the period 1975–84 is 0.36 per cent per annum, but this result is statistically insignificant. An ADF and Phillips–Perron Unit Root test is performed on the residuals of regression equation. The value of the test statistics is -4.53 and -4.489 , respectively. The MacKinnon approximate p -value for the test statistics is 0.0002 and 0.0002, respectively. Thus, the residuals are independent of any time trend.

Though there is some fall in the absolute value of the rate of decline of the terms of trade index of manufactured goods after the exclusion of non-ferrous metals, that does not disprove the ‘deterioration hypothesis’. Hence, one can conclude from

Table 2 Regression Results of the Manufacture–Manufacture Terms of Trade Index (SITC 5 to 8 less 68), US\$ index (1975–2000)

Period	Annual Growth Rates	t-statistics	Adj. R ²	F-value	Root-Mean Square Error
1975–1984	0.36%	(0.76)	0.799	34.21	0.04334
1985–2000	(-) 0.91%**	(-2.40)			

Source: Author's calculations.

Note: ** indicates that the results are significant at 95 per cent level of significance.

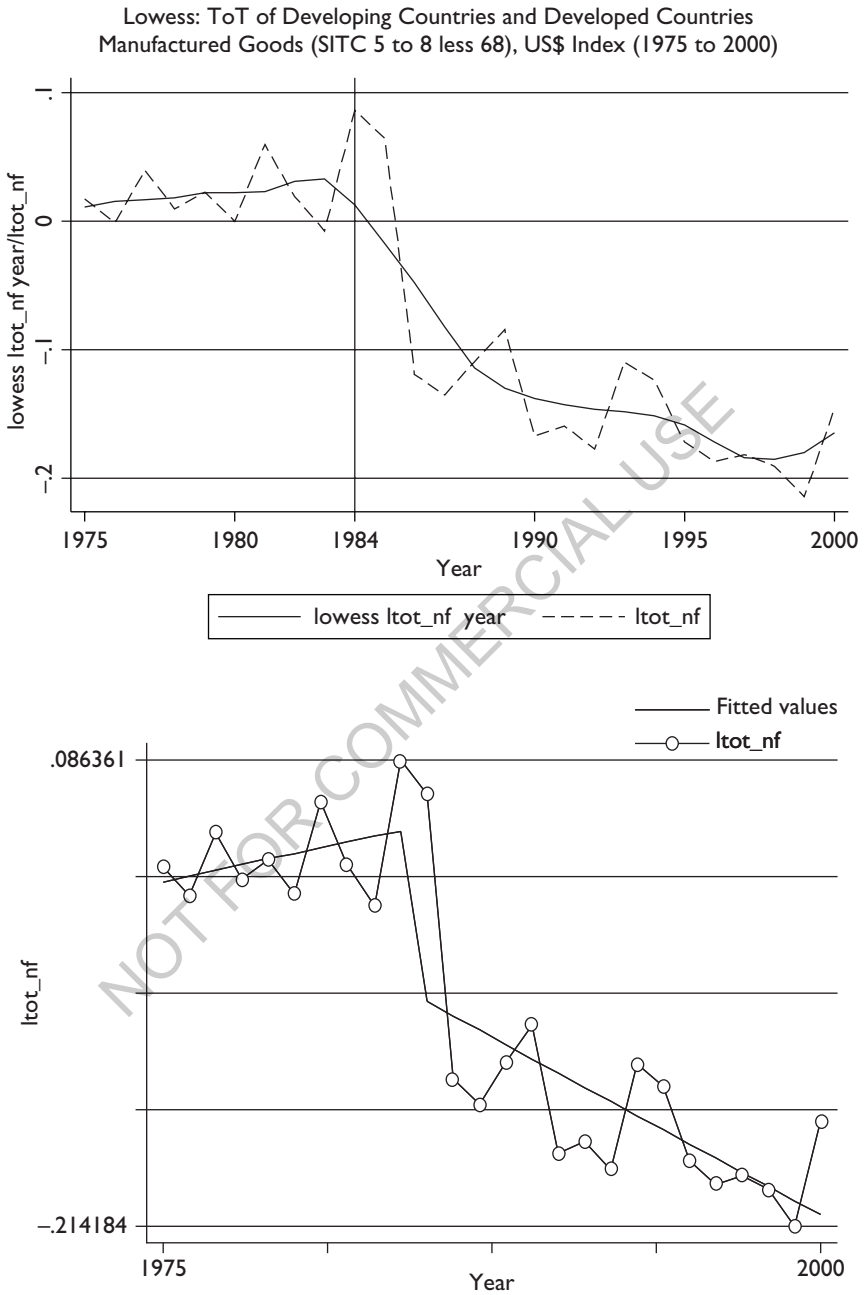


Figure 5. A Comparison of the Lowess Curve with the Fitted Values (ToT) (SITC 5 to 8 less 68) (1975 to 2000)

Source: Author's calculations.

these results that there has been a secular decline in the manufacture–manufacture terms of trade of developing countries vis-à-vis developed countries, whether the non-ferrous metals are included or excluded from the definition of manufactured goods.

Factors Responsible for the Secular Decline in Manufacture–Manufacture Terms of Trade

Having established the fact that the manufacture–manufacture terms of trade of the developing countries vis-à-vis the developed countries has deteriorated over the years, it becomes important to identify the factors responsible for such a secular decline. The manufactured goods produced in the world economy can be classified into two broad categories of products—(1) the ‘simple’ manufactured goods produced by the developing countries as well as the developed countries and (2) the ‘sophisticated’ manufactured goods produced mainly by the developed countries, which are beyond the purview of the developing countries due to lack of advanced technologies.

The developed countries produce hi-tech, sophisticated manufactured goods, which are technologically much more advanced than those produced by the developing countries. These advanced technologies are primarily located in the developed countries, which give them the ability to produce these ‘sophisticated’ manufactured goods. This is primarily on account of a dominant technology based upon Research and Development (R&D) monopoly of the advanced capitalist countries. The high level of R&D expenditures in developed countries helps in innovation of new technologies and products and thereby the production of new ‘sophisticated’ manufactured goods. On the other hand, the manufactured goods produced by the developing countries are simple goods, which are mostly mere value additions to the primary commodities without involving much sophisticated technological processes. The developing countries continue to remain trapped in the traditional international division of labour, modified by the fact that it is not primary products alone which are the province of third world, but the lower-level manufacturing activities which involve a degree of value addition to primary products.

As far as these ‘simple’ manufactured goods are concerned, the developing countries have an advantage over the developed countries because of the low wage rate (in terms of food) paid to the workers in these countries.⁸ This is primarily because there is a huge ‘reserve army of labour’ located in the developing countries, which keeps the wages (in terms of food) in the developing countries tethered to the subsistence level. The developing countries can increase their global market share in these ‘simple’ manufactured goods and outperform the developed countries since the wages in the developed countries are higher than those prevalent in the developing countries. On the other hand, in the production and

marketing of the 'sophisticated' manufactured goods, the developed countries have a clear advantage over the developing countries. Since the advanced technologies required for the production of these goods are primarily located in the developed countries, these countries have the potential to produce these products, which the developing countries lack. The developed countries also enjoy a 'monopoly' power in the marketing of these 'sophisticated' manufactured goods since they do not face competition from the developing countries in these products.⁹ Hence, the developed countries are in an advantageous position to set the prices of these manufactured goods. Therefore, given this production and marketing conditions in the developed countries, one can assume that there is a 'downward rigidity' on the prices of the manufactured goods produced in the developed countries.

If the 'simple' manufactured goods produced by the developing countries enter as raw materials in the production of the 'sophisticated' manufactured goods of the developed countries,¹⁰ then the factors responsible for the secular deterioration in the terms of trade of primary commodities vis-à-vis manufactured goods once again become appropriate in explaining the secular deterioration of the manufacture–manufacture terms of trade of the developing countries vis-à-vis the industrialised countries. Theoretically, if there is a system of mark-up pricing in the manufactured goods sector of the advanced world, an increase in the post-tax wage share or an increase in the share of post-tax profits or an increase in the share of taxes in the gross value of manufacturing output produced by the advanced capitalist countries can lead to a secular decline in the manufacture–manufacture terms of trade of the developing countries vis-à-vis the developed countries.¹¹

Furthermore, if there is a 'downward rigidity' on the prices of manufactured goods of the developed world, then in a world of freely moving finance capital, the secular tendency for the exchange rate of the developing countries to depreciate can give rise to a secular decline in the manufacture–manufacture terms of trade of the developing world vis-à-vis the developed. Even if the manufactured goods produced in the developing world do not enter as a raw material in the production of the manufactured goods of the developed world, then also a secular depreciation of the currencies in the third world countries can lead to a secular decline in the manufacture–manufacture terms of trade of the developing countries vis-à-vis the developed countries since the relative wages of the former vis-à-vis the latter will keep declining over time for given levels of money wages in their respective currencies.

Following Prebisch (1950) and Singer (1950), a similar argument can be made for the differential impacts of technological progress in the manufactured goods sector on the prices of these products in the developing countries and the developed countries. In the long run, with technological progress in the manufacturing sector of the developed countries as well as the developing countries, the labour productivity increases in this sector of both these countries. In the developing countries, with technological progress over a period of time, the prices of the manufactured goods (in terms of food) decline. This is due to the fact that the

wages of the workers (in terms of food) in the developing countries do not rise with an increase in the labour productivity because their wages remain tied to the subsistence level. However, in the developed countries, an increase in the labour productivity with technological progress does not get reflected in a fall in the prices of the 'sophisticated' manufactured goods (in terms of food) since we have argued that there is a 'downward' rigidity in the prices of these manufactured goods. In the long run, an increase in the labour productivity in the developed countries gets absorbed in the form of higher factor incomes of the manufactured goods sector, that is, the wages (in terms of food) of the workers in the developed countries might rise or the profit margin of the capitalists might increase over time. Hence, with technological progress in the manufacturing sector, the prices of the manufactured goods decline (in terms of food) in the developing countries, whereas in the developed countries the prices of these products remain more or less rigid or rise but do not fall (in terms of food). This leads to a secular decline in the manufacture–manufacture terms of trade of the developing countries vis-à-vis the developed ones.

Is Diversification to Exports of Manufactured Goods an 'Escape Route' from the 'Deterioration Hypothesis'?

The developing countries attempt to industrialise and their effort to diversify the export baskets with an increase in the share of manufactured goods proved successful for some developing countries, especially the East Asian Tigers and some countries like China.¹² However, this model of development of East Asian economies cannot be easily replicated by other developing countries, even though these countries may have an advantage in terms of the lower wages (in terms of food) paid to their workers compared to those of the developed countries. There are mainly two problems associated with the replication of such a model. First, one of the main factors contributing to the remarkable success of such a development model is that it was mainly confined to a few nations. But if all the developing countries would have attempted to raise their share of manufactured goods in the world market, then it would have led to the fallacy of aggregation. Since the technological capacity of the developing countries, even countries like China and India, are limited, they cannot compete with the advanced countries in a whole range of activities. In the remainder they compete against one another, which means that all cannot be as successful exporters as some have been till now. The collective success of all developing countries emulating East Asia would be far less significant than what has been achieved by a few in East Asia. Second, the historical context of the export drive of the East Asian economies is far different from the present world scenario. The East Asian expansion drive was taken at a point when world trade was expanding at an extremely rapid rate and world capitalism was in the midst of a pronounced boom. But the present state of affairs in

the world economy is completely different from the past. In the present scenario, the world economy is going through a recession and the growth rate of the advanced capitalist countries has plummeted. The developed countries are far more cautious about protecting their economies from the threats of cheap manufactured imports from China and other East Asian economies. Hence, in such a scenario, it is extremely difficult for the developing countries to expand their manufactured goods share in the world trade, even if they intend to do so by reducing the price level.

Rather, to escape from the problem of ‘deterioration hypothesis’ and to further increase their share in the world market of manufactured goods, the developing countries will have to concentrate on building up indigenous scientific and technological capacities and increase their R&D expenditures in the development of new techniques and products to compete with the developed world as innovators in the manufactured goods market. But, for this innovation, a minimum scale of capital is a precondition, which applies not only to the innovation of new technology but also for their imitation. However, there are a few limitations of the imitation process—the drawback of imitation is that even if the developing countries are successful in imitating, it happens with a time lag. Within this time lag, though the developing countries have successfully imitated the technology of the already produced manufactured goods of the advanced countries, the latter have shifted to a totally new and different production technology and introduced even newer ‘sophisticated’ manufactured goods into the scene. Thus, the developed countries are always in an advantageous position as innovators of new products and can set the price level in the world market of manufactured goods. The developing countries can be in a better position in the global market of manufactured goods if they can become successful innovators. But, as discussed by Patnaik (1997: 227), the precondition for them to be successful innovators is

... where the minimum scale of production is not prohibitively large, where the scale of the home market in which a footing must first be obtained is also correspondingly large, where the technology in question is relatively simple and does not require the use of sophisticated technology in a number of complementary spheres.

If there is an increase in the innovation promoting expenditure by the state in the developing countries, then it can lead to development of newer and newer sets of blue prints of techniques and also encourage the innovation of newer ‘sophisticated’ manufactured goods. Nonetheless, it is important to note here that, given the high level of unemployment prevalent in the underdeveloped countries, the kind of technological progress involved in the innovation of manufactured goods in the developing countries should be of such a nature that it is able to absorb the huge ‘reserve army of labour’ which persists in these countries.¹³ If this ‘reserve army of labour’ gets absorbed in the production process, then the benefits of such technological progress will accrue to the working population in these countries. So, technological progress leading to innovation of new products and newer

production techniques in the developing countries should be such that the 'reserve army of labour' gets used up in these countries; otherwise, all the benefits of such innovation promoting expenditure by the state leading to manufacture of newer products, development of newer techniques and an increase in the market share of manufactured goods will accrue to the capitalists of the developing countries in the form of a higher profit margin and the wages of the workers will remain tied to the subsistence level. Therefore, even the innovation of manufactured goods should come through such technological means that it eventually reduces the high level of unemployment, which prevails in the developing countries and improves the living standard of the working population in these countries.

However, this innovation promoting expenditure is only one element. Discussing on the limitations of increasing only innovation promoting expenditures, Patnaik (1997: 142) argued:

An identical relative level of flow expenditure on the promotion of innovations in two different countries would have quite different results if the already existing facilities of research and development, the levels of domestic skill development, the levels of literacy and education in society, the levels of development of the financial infrastructure, and the levels of transport and communications development vary widely between them. A minimum infrastructure for product innovation destined for the world market must exist if flow expenditure on innovation promotion is to make a difference to the country's status as an innovator on the world economy.

Hence, there should be more emphasis on the development of infrastructural facilities in the developing countries along with building up of technological capacity, entrepreneurial skills and improving 'human capital' in general. It is the responsibility of the state to increase investments for the development of communications, transport, financial and marketing infrastructures. For this, the state has to increase its development expenditures on these infrastructural facilities so that it facilitates the developing countries to become innovators in the world market. This would need an active participation of the state in the development of their respective infrastructural facilities in the domestic economies and also increase their research and development expenditures.

Conclusion

This article tries to sketch a scenario of the export market of manufactured goods for developing countries mainly from the 1970s. The study finds that especially since the 1970s, the developing countries were able to increase their share of manufacturing exports in the global market. However, these exports were concentrated mainly in the hands of the South East Asian Tigers along with a few other countries like China and India. But the alarming point is that the developing countries attempt to diversify their exports to manufactured goods did not provide a

way out from the 'deterioration hypothesis'. From 1975 to 2005, the net barter terms of trade of manufactured goods of developing countries vis-à-vis developed countries experienced a secular decline at an annual rate of -0.96 per cent. In the literature, some doubts were raised over the statistical index used and it was claimed that the inclusion of non-ferrous metals within manufacturing generated these results. Even after excluding non-ferrous metals from the definition of manufactured goods, the study still finds a tendency of secular decline at a rate of -0.91 per cent per annum in the newly defined net barter terms of trade of manufactured goods of the developing countries vis-à-vis the developed ones.

To identify the factors responsible for this secular decline in the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed countries, this article characterised the manufactured goods produced in the world economy into two broad categories: (1) the 'hi-tech', technologically advanced sophisticated goods produced mainly by the developed countries, and (2) the 'simple' manufactured goods produced in the developing countries as well as the developed countries. If the 'simple' manufactured goods produced by the developing countries enter as raw materials into the production of 'sophisticated' manufactured goods of the developed countries, then the factors that are responsible for the secular decline in the terms of trade of primary commodities vis-à-vis manufactured goods will also become pertinent in explaining the secular decline in the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed countries. Even if manufactured goods of the developing countries do not enter as raw materials in the production of the manufactured goods of the industrialised nations, then also a secular tendency of the third world countries' currencies to depreciate will lead to a secular decline in the manufacture-manufacture terms of trade of the developing countries vis-à-vis the developed world. Moreover, with technological progress in the manufactured goods sector, the prices of the manufactured goods produced by the developing countries tend to fall (in terms of food) over time, whereas the prices of the 'sophisticated' products produced by the developed countries remain more or less the same or rise (in terms of food). In totality, all these factors contribute for a secular decline in the manufacture-manufacture net barter terms of trade of the developing countries vis-à-vis the developed countries over the years.

In this article, we argue that a blind pursuit of the East Asian country's strategy of development by the other developing countries may not be beneficial for the developing countries as a whole. To improve their position in the global market for manufactured goods, the developing countries have to occupy the seat of innovators in the production of manufactured goods. For this to happen, the state of the developing countries will have to increase not only their R&D expenditure in improving technological capacities, entrepreneurial skills and 'human capital', but at the same time increase development expenditures in the building of infrastructural facilities and improving them. And even then their labour reserves are unlikely to get absorbed until and unless the technology used in the production of these newly innovated goods is 'labour absorbing' in nature.

Appendix

First, a smoothing procedure is used called lowess, which stands for *locally weighted regression scatter plot smoothing*, to have a visual design of the movements in the time-plot of the terms of trade index. Lowess, as defined by Cleveland and Devlin (1988: 596), is ‘a procedure for fitting a regression surface to data through multivariate smoothing: The dependent variable is smoothed as a function of the independent variables in a moving fashion analogous to how a moving average is computed for a time series’.

Smoothing by local fitting is an old idea and dates back to the work of Macaulay (1931). This methodology is deeply buried in the time series models, where data measured at equally spaced points in time were smoothed by the local fitting of polynomials. This idea was further developed by Watson (1964), Stone (1977), Cleveland (1979), Cleveland and Devlin (1988) and Fan et al. (1996).

Lowess specifically denotes a method usually descriptively known as locally weighted polynomial regression. At each point in the dataset a low-degree polynomial is fitted to a subset of the data, with explanatory variable values near the point whose response is being estimated. The polynomial is fitted using weighted least square procedure, giving more weight to points near the point whose response is being estimated and less weight to points further away. The value of the regression function for the point is then obtained by evaluating the local polynomial using the explanatory variable values for that data point. The lowess fit is complete after regression function values have been computed for all the data points. Many of the details of this method, such as the degree of the polynomial model and the weights, are flexible. A user-specified input to the procedure called the ‘bandwidth’ or ‘smoothing parameter’ determines how much of the data is used to fit each local polynomial. It is called the smoothing parameter because it controls the flexibility of the lowess regression function. However, greater the value of the ‘bandwidth’, greater the smoothing effect but less may be the details of the curve. In practice, the choice of the bandwidth mainly ranges from 0.4 to 0.8.

Mathematically:

Let (x_i, y_i) be an observation in a scatter plot of y against x . In the lowess procedure, the user chooses f , a fraction of the points to be used in the computation of each fitted value. Suppose, a variable g be defined as fn rounded to the nearest integer, where n is the number of all data points, that is, the size of the data. Let d_i be the distance from x_i to its g th nearest possible neighbour along the x axis (x_i is counted as a neighbour of itself). Then the weight given to any point in the rectangular coordinate system, namely, (x_k, y_k) when computing a smoothed value at the x_i is defined as

$$w_k = T(x_i - x_k/d_i) \quad (\text{A1})$$

$$\text{where,} \quad T(u) = (1 - |u|^3)^3, \quad \text{for } |u| < 1 = 0, \quad (\text{A2})$$

otherwise

is the tri-cube weighted function and $u = \{(x_i - x_k)/d_i\}$.¹⁴

If $d_i = 0$, that is, the g th nearest neighbours of x_i all have abscissas equal to x_p , then points whose abscissas are equal to x_p , are given weights one and all other points are given weight zero. In such a case, a constant is fit instead of a line. Thus, to compute the fitted value at x_p , a line (or a constant if $d_i = 0$) is fitted to the points of the scatter plot using weighted least squares with weight w_k at the point (x_k, y_k) . Hence, the estimated values of a and b are found by minimising the equation.

$$\sum_k w_k(x_k)(y_k - a - bx_k)^2 \quad (\text{A3})$$

If $a_{estimate}$ and $b_{estimate}$ are the values that achieve the minimum, then we have

$$b_{estimate} = \{\sum w_i^2(x_k - x_{mean})(y_k - y_{mean}) / \sum w_i^2(x_k - x_{mean})^2\} \quad (\text{A4})$$

and,
$$a_{estimate} = y_{mean} - (b_{estimate})(x_{mean}) \quad (\text{A5})$$

where y_{mean} and x_{mean} are the weighted means of y and x , respectively.

Then, the fitted value at x_i is defined to be

$$(y_i)_{estimate} = a_{estimate} + b_{estimate}(x_i) \quad (\text{A6})$$

A time series is a set of data connected over a span of time in a definite ordering given by the sequence in which the observations occurred. Conceptually, for the purpose of modelling, a time series data is considered to compose of three components—a trend (smooth line or curve), a cycle (or combination of cycles) and fluctuations (irregular components). The trend is basically a broad direction of change over time. It is an abstraction in the form of a smooth line or curve.

As already discussed in the literature, there might be more than one structural break in the data series. It is important to note here that the whole idea behind looking at the structural breaks is to mark the periods where the shifts in the terms of trade might have been due to some factors which are quite exogenous to the system. One of the most useful devices to model a data series with structural breaks is the use of binary, or dummy, variables. A dummy variable takes a pre-assigned value (or in some cases the value one) for some observations to indicate the presence of an effect or membership in a group and zero for the remaining observations. These variables are a convenient means of building the discrete shifts of the function (or the dataset) into a regression model. With the help of these dummy variables, we want to find the trend or the growth rate of a random variable over an individual sub-period in a given time span. This form of regression is commonly known as the *piecewise semi-log linear regression* for trend fitting (Boyce 1986).

Suppose Y_t is a time series data set, where the variable Y denotes the random variable and t denotes the time variable. We assume that the data set has a break

at time period k ($0 < k < t$). If there are good reasons to believe why the break had occurred at the point (k), then we can refer to it as a structural break. Let us define a dummy variable such that:

$$\begin{aligned} D_t &= 0, & \text{if } t \leq k \\ &= (t - k), & \text{if } t > k. \end{aligned} \quad (\text{A7})$$

Now, the linear regression model is of the form:

$$\ln Y_t = a + b.t + c.D_t \quad (\text{A8})$$

Therefore,

$$\begin{aligned} \ln Y_t &= a + b.t & \text{if } t \leq k \\ &= (a - c.k) + (b + c).t & \text{if } t > k \end{aligned} \quad (\text{A9})$$

Thus, one can argue from here that b is the growth rate in the first period (that is, $t \leq k$) and $(b + c)$ is the growth rate for the second period (that is, $t > k$). The dummy variable D_t defined this way ensures that the two trend lines, corresponding to the two periods, meet at the breakpoint k . However, one must note that this specification is useful only when there is no jump at the breakpoint.

For example, the first regression analysis done in this study is with Z_t as the regressand and t as the regressor. The dummy variable is defined as:

$$\begin{aligned} D_t &= 0, \text{ for } t = 1975 \text{ to } 1984 \\ &= 1, \text{ for } t > 1984. \end{aligned}$$

Now, the linear regression equation can be defined as

$$\log(Z_t) = \{a + b.(D_t)\} + \{c + e.(D_t)\}.t, \quad (\text{A10})$$

Then, from the period 1975–84, Equation A10 assumes the form

$$\log(Z_t) = a + c.t \quad (\text{A10[a]})$$

and from the period 1985–2005, Equation 10 can be written as

$$\log(Z_t) = (a + b) + (c + e).t \quad (\text{A10[b]})$$

Thus, from Equations 10(a) and 10(b), one can argue that the annual rate of growth of the terms of trade index in the first period, that is, from 1975 to 1984 is c , whereas $(c + e)$ denotes the annual rate of growth of this index in the second period, that is, from 1985 to 2005.

Notes

1. However, the industrial strategy of the Prebisch–Singer hypothesis did not suggest clearly whether industrialisation would be through export-promotion or import-substitution. But, in some of his later writings, Singer (1998) clarified that there was a natural preference for import substitution in the 1950s for the developing countries.
2. The figures have been cited from A. Maizels et al. (1998).
3. Calculations are based on figures available from WTO Trade Statistics, various issues and UNCTAD Handbook of Statistics, various issues.
4. These statistics have been cited from Sarkar and Singer (1991: 335).
5. A detailed definition of all these various concepts of terms of trade has been given in Rostow (1950).
6. For a detailed note on the criticisms of the terms of indices commonly used in the literature, see Staehle (1951).
7. In a personal email correspondence with the United Nations Statistical Division, the author asked for the updated data entitled ‘Export price Indices of Primary commodities and non-ferrous base metals’ (Serial Number-37) on an annual basis. However, the United Nations Statistical Division replied that the series is no longer available in the post-2000 period. So, in our present analysis, the data ranges from 1975 to 2000.
8. According to Bureau of Labour Statistics (2006), China’s average hourly compensation in manufacturing is estimated to be only 3 per cent of the US level at the current exchange rate (Cited from Krugman [2008: 106]).
9. The marketing of the ‘sophisticated’ manufactured goods is mainly done by the multinational corporations and the big business houses. These multinational corporations and big business houses are mainly concentrated in the advanced countries. There is a centralised decision-making power of the multinational corporations in setting the prices of manufactured goods in the world market. According to Singer (1975: 376):

The investing countries are the seats of the multi-national corporations, the homes of a modern autonomous appropriate technology, and are economically integrated societies in which the marginal groups are definable minorities (and even they tend to participate in the gains from progress, at least through social welfare). Being all this, the investing country will tend to be the chief gainer from *any* kind of relationship, whether the trade or investment or transfer of technology involves primary commodities or manufactured goods.

10. Developing countries’ share of global intermediate goods exports dramatically increased from 3.9 per cent to 31.7 per cent from 1988 to 2006 (Source: Sturgeon and Gereffi [2009]). For example, the intermediate manufactured goods export had a share of 71 per cent in the total exports of Chinese Taipei during 2008 (Source: World Trade Developments, WTO 2009).
11. The factors responsible for a secular decline in the terms of trade of primary commodities vis-à-vis manufactured goods are discussed in greater details in Patnaik (1997, 2002, 2008).
12. The success of the East Asian Economies and the policies adopted for their success is discussed in great details in Ghosh and Chandrasekhar (2001) and Patnaik (1997: 232).

13. This argument will also hold true if the underdeveloped countries are mere imitators of manufactured goods originally produced by the advanced countries. It is desirable from the perspective of the working class in the developing countries that the technology involved in the innovation or even in the imitation of the first world countries' manufactured goods be labour absorbing. This is due to the fact that every technological progress involves an increase in the labour productivity. If a huge level of unemployment prevails in the developing countries, then any such improvements in the labour productivity through technological progress will be lost in the form of lower prices of the manufactured goods (if they are imitators of the first world countries goods or producers of 'simple' manufactured goods) or an increase in the profit margin of the capitalists (if they become innovators of new 'sophisticated' manufactured goods). But if the labour reserves get absorbed with the introduction of new technologies (assuming that the technologies are labour absorbing), then such increases in the labour productivity might get absorbed in the form of higher wages (in terms of food) in the developing countries.
14. The computation of weights is a three-step process: (1) determining the distance from each point to the point of estimation; (2) scaling the distances by the maximum distance over all points in the local dataset; and (3) computing the weights by evaluating the tri-cube weight function using the scaled distances.

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