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The Manufactures Terms of Trade of Developing Countries with the United States, 1981-97

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There is an ongoing debate on whether or not developing countries suffer a trend deterioration in their terms of trade in their exchange of manufactures with developed countries. In a contribution to this debate, this paper analyses trends in the prices of US imports and exports of manufactures in trade with developing countries, and – for comparative purposes – with other developed countries. The results show a significant terms of trade deterioration for developing countries over the first half of the 1980s, with no significant change since then, while for other developed countries their manufactures terms of trade vis-à-vis the US was trendless in the 1981-85 period, with significant improvement since. Over the whole period studied, the manufactures terms of trade of developing countries with the US thus showed a relative deterioration compared with the corresponding terms of trade of other developed countries. The paper also considers probable causes of this relative deterioration.

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Introduction

In an important contribution to the ongoing debate on trends in the terms of trade between developing and developed countries, Sarkar and Singer (1991) extended what had been essentially a theoretical discussion into the field of empirical analysis, focussing on the exchange of manufactures between these two groups of countries. Earlier empirical work had been concerned with testing whether the original Prebisch-Singer hypothesis (Prebisch, 1950; Singer, 1950) of a long run deterioration in the terms of trade of developing countries was valid as regards the exchange of primary commodities exported by developing countries for manufactures supplied by developed countries. However, both Prebisch and Singer had viewed the 'vertical' exchange of commodities for manufactures as a proxy for the analysis of trade relationships between developed and developing countries.

In a later review of his original 1950 paper, Singer elaborated on the influence of scientific and technological capacities on the terms of trade of developing countries. Singer argued that since the developed countries have a near-monopoly of technological innovation, they can effectively determine not only the direction of technical progress in developing countries, but also access to all the relevant information necessary for successful bargaining. This asymmetry results, he argued, in a deterioration in the position of the developing countries in all their dealings with developed countries, including a deterioration in their terms of trade (Singer 1971). This argument would seem especially relevant to the exchange of manufactures between developed and developing countries.

Singer's emphasis on the role of technological innovation raises some wider questions also. If it is the case that the terms of trade of developing countries tend to deteriorate in their exchange of manufactures with the technologically superior developed countries, can we expect a causal relationship of this kind to operate also for different groups of developing countries, perhaps with their degrees of terms of trade deterioration being related to the levels of technological sophistication embodied in their manufactures exports? Again, would this kind of relationship operate also *within* the developing world, with deteriorating terms of trade trends for those countries at earlier stages of industrial development in their exchanges of manufactures with developing countries at higher stages and with more sophisticated technological content in their manufactured exports?

The Sarkar-Singer paper considered the terms of trade trends of developing countries exporting manufactures in several ways. First, the authors showed that over the period 1970-87 the unit values of manufactures exported by developing countries as a group declined by about 1 per cent per annum in relation to those of developed countries. However, as a result of the sharp expansion in the volume of manufactures exported by developing countries there was an average annual increase of 10 per cent in their income terms of trade. Second, an analysis of trends in the terms of trade for the period 1965-85 for almost 30 individual developing countries was made, but the results appeared inconclusive – those for about half the countries being not statistically significant – while there were both positive and negative manufactures terms of trade trends among the other countries. However, the unweighted trend for all the countries taken together was negative (-0.65 per cent per annum) which, argued Sarkar and Singer, broadly confirmed the results of their aggregate analysis.

Third, a review was made of trends in the relative unit values of manufactured exports from each of these countries with the corresponding unit value index for the United States. The majority of countries showed significant deterioration in their relative export unit values, while no country showed a significant improvement. Sarkar and Singer concluded that some evidence of decline had been found in the unit value of manufactured exports of the 'periphery' compared with those of the 'centre' over the 1970-87 period, though the separate country series did not yield conclusive results.

The Sarkar-Singer analysis has, however, provoked a number of criticisms, particularly by Athukorala (1993), who emphasised the unreliability of unit value indices as indicators of 'genuine' price changes, since they are influenced also by changes in the commodity mix. Moreover, the aggregate unit value series used by Sarkar-Singer relate to the total exports of developed, and of developing, countries, and not to the trade between these two country groups. This is likely, Athukorala argued, to bias their results. In a more recent study, Athukorala (1998) analysed the terms of trade trends for manufactured exports from all developed countries (1959-89), and for three developing countries – India (1971-86), South Korea (1970-90) and Taiwan (1976-90) – using cointegration techniques, and found that in all cases, the terms of trade had been 'basically trendless' (*ibid.*: 212-14).

Before turning to our own research into recent terms of trade trends it is useful to consider further the first two of Athukorala's criticisms:

(i) Unit value versus price indices

There are three essential differences between these indices:

(a) Composition. While genuine price indices relate to the prices of goods with unchanged specifications (i.e. having constant quality and technical properties), unit value indices are derived by dividing the recorded values of foreign trade headings by the corresponding recorded quantities. Since individual statistical headings normally include many varieties and quantities of particular products, in addition to a range of related products, there is considerable scope for erratic movements in the relevant unit value index over time. Moreover, in addition to such changes in the 'within headings' composition, there are often substantial shifts in the relative values of the various statistical headings with broader categories, such 'between headings' shifts often dominating the unit value changes over time, thus providing misleading indicators of the underlying price trend. For this reason, changes over time in the relationship between the price and unit value indices for any given statistical heading in the foreign trade accounts can not be taken to indicate changes in the 'quality' of the manufactures covered.

(b) Weighting. Unit value indices are normally computed with current weights, so that the year to year changes in unit values reflect a combination of price change and composition changes, as well as changes in quality of individual products. By contrast, price indices

are normally calculated with fixed base weights, so that the index change excludes the influence of changes in product mix or quality.

(c) Coverage. Unit value indices normally aim to cover all statistical headings used in the foreign trade accounts; where certain headings record value but not quantity, the unit value change is usually assumed to be the same as for a closely related item or items for which both value and quantity figures are recorded. By contrast, price indices are normally confined to a specific, sometimes limited, list of statistical headings, selected so as to constitute a reasonably representative sample. An important special case arises when the quantity unit for trade is inappropriate for a particular manufactured product. This is clearly the case, for example, with information technology (IT) products, the quantity of which is generally recorded in tonnes in statistics of foreign trade, so that unit values could well show a marked divergence from the corresponding price changes.

The difficulties surrounding the use of unit values have led the US to develop genuine price indices for their own foreign trade. The official US unit value indices were discontinued in 1989, while the new price series, compiled and published by the Bureau of Labour Statistics (BLS), were phased in at various dates over the preceding decade or so. These latter indices form the basis for the present study of medium-term trends in the terms of trade of developing and developed countries in their exchanges of manufactures with the US.

Considerable effort has clearly been made by the BLS to ensure that the prices used relate to products having unchanged 'quality' in terms of technical specification. Where significant specification changes are made, 'product substitution is made by an adjustment process . . . that ensures the index reflects only actual or "pure" price changes and is not affected by quality changes' (Alterman, 1991:114).[1]

(ii) Total trade versus inter-country group trade.

Whether or not the relationship between unit values of manufactured exports from developing countries (to the world) and the corresponding unit values for developed countries is an acceptable proxy for the unit value relationship in their mutual trade is an empirical issue. One approach here would be to consider separately the exchange of manufactures between developing countries and i) the European Union, ii) the US, and iii) Japan, the principal developed countries involved. This approach would have some advantages: it allows the use of the new US series for foreign trade prices, and it should also help in assessing the relative importance of different explanatory variables where their impacts vary significantly as between the trade links of developing countries with each major developed country or region.

An analysis of the terms of trade trends in the exchange of manufactures between developing countries and the EU has recently been

published (Maizels, Palaskas and Crowe, 1998). Based on unit value series for the period 1979-94 prepared by EUROSTAT[2], it shows that:

- The average rate of change in manufactures export unit values over the period studied was the same (4.2 per cent per annum) for manufactures exports from the EU to developing countries and for exports to developed countries (including EU intratrade). To the extent that the EU is representative of manufactures export unit values from all developed countries, this result would support the Sarkar-Singer analysis.

- There were marked differences, however, in the average rates of change in unit values of EU imports of manufactures, not only as between developed and developing countries, but also as between different developing regions, which were reflected in corresponding differences in changes in their manufactures terms of trade. A definite pattern seemed to emerge, with the most technologically advanced – East and South East Asia – experiencing the smallest rate of deterioration in the manufactures terms of trade, and the least technologically advanced – the 'least developed', consisting mainly of countries in sub-Saharan Africa – experiencing the greatest rate of deterioration. Latin America and the Mediterranean developing countries fall into intermediate position, both of their levels of technology and of the degree of deterioration in their manufactures terms of trade.

- However, for each region, the terms of trade deterioration was more than offset by relatively large increases in the volume of EU manufactures imports – reflecting corresponding increases in the volume of manufactures exports from developing countries to the EU – thus resulting in improving income terms of trade for the developing countries.

One possible inference from these findings is that countries at early stages of industrial development, with manufactures exports consisting mainly of labour-intensive and resource-intensive products, sell in highly competitive world markets which operate very much as do the markets for primary commodities. By contrast, the exports of the industrially more advanced developing countries include a substantial proportion of skill-intensive and capital-intensive products, where markets are much more influenced by technological innovation, and where prices are determined generally on a 'cost-plus' basis.

If these inferences are borne out by similar analyses of the manufactures terms of trade of developing countries vis-à-vis other developed countries, particularly the US – the biggest single market for manufactures exports from developing countries – the above findings would have important implications for development strategy. This would be especially so for commodity-dependent countries, whose efforts to expand exports of labour-intensive or resource-intensive manufactures in competitive world markets may be nullified, at least in part, by consequent deterioration of their terms of trade.

Us Foreign Trade Prices: Some Methodological Issues

The immediate problem that arises in any attempt to assess changes in developing countries' terms of trade vis-à-vis the US, is that neither the latter nor the former publish price (or even unit value) series for their mutual trade in manufactured goods. In very recent years, the official foreign trade price series published by the BLS have been supplemented by separate series for import prices of manufactures from developed and from developing countries, with corresponding price indices for imports from Canada, the EU, Japan, and the NICs (Hong Kong, South Korea, Singapore, and Taiwan).[3]

However, these new import price indices are too recent to be used to compute any meaningful long-term, or even medium-term, trends. Moreover, corresponding price series for US exports by area of destination are not available. Thus, the only way of studying trends in developing (and developed) countries' manufactures terms of trade vis-à-vis the US is by creating quite new indices for this purpose.

The new 'short cut' price indices.

It was clear, to begin with, that it would not be possible to follow normal BLS procedure of analysing the commercial documents for the trade of a large number of countries with the US, in each case covering a considerable list of individual products.[4] Such documents are nor available to outside researchers, nor would it be practicable to analyse them within the modest resources of the present project. Instead, a 'short cut' method had to be devised that was easy to use and would produce acceptable results in the sense of having only a relatively small margin of error.

This is by no means a new problem. It was first confronted by Kindleberger in preparing his pioneering study on trends in Europe's terms of trade, covering six selected years from 1872 to 1952 (Kindleberger, 1956). Since he wished to compute changes in unit values and volume for trade with each of 5 extra-European areas by 8 European countries, while for each country there were many hundreds of commodity headings to be separately treated, many thousands of separate unit value calculations would have been required if the full commodity/ country details were to be used. As a result, Kindleberger was compelled to adopt a short-cut method to complete his study within a reasonable time. This method was to aggregate commodity headings wherever this seemed justifiable, treating the aggregate as if it were a single homogeneous product. A notable example was the use of the aggregate value and weight figures for machinery as a whole in the calculation of the unit value index numbers for the UK, France, Germany and Italy.

This method was criticised as depending for its validity on the implicit assumptions of zero variance in the quantity relatives of the items aggregated, and of equal prices per unit of these items in the base period (Maizels, 1957). However, where changes in the volume of trade have taken place over a period of years, considerable dispersion of quantity relatives will be a normal occurrence and the commodity-aggregation method is likely to produce misleading results (*ibid.*). Instead it was suggested that an acceptable short-cut method would be to assume that

'the unit value index numbers for export of individual commodities *are valid for all areas*' (italics in original), since 'individual commodities would each be subject to the same cost conditions in the producing country, irrespective of the eventual area of destination'. However, it was added that 'this assumption would not necessarily hold . . . if demand conditions were very different in different areas, e.g. if in one area there were intensely competitive conditions, while in another there was a supplier's monopoly. But apart from cases of this sort, this assumption appears to be a reasonable one to make' (*ibid.*).

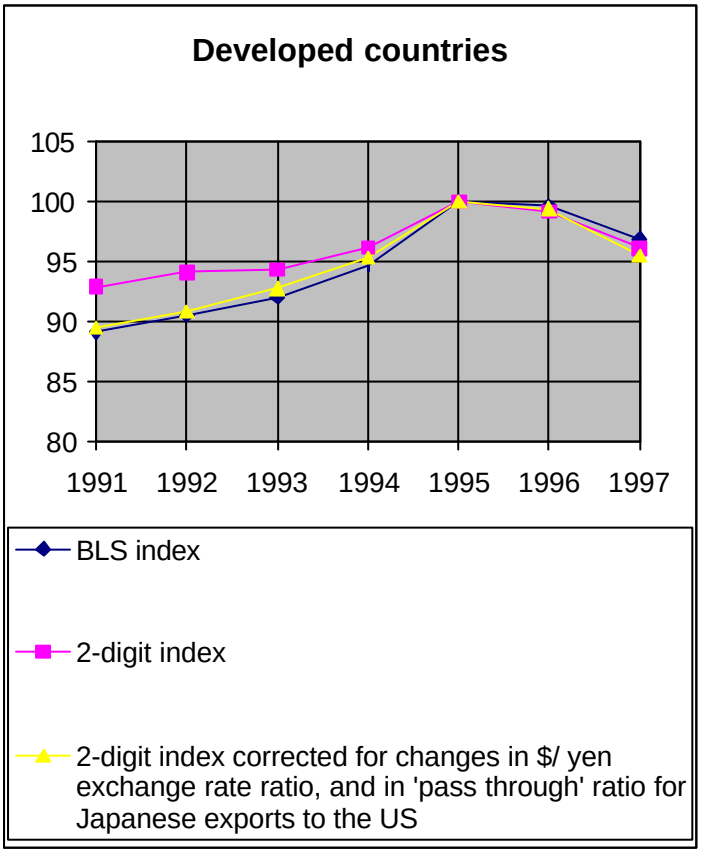
This assumption – the 'law of one price' – is likely to be even more reasonable when applied to export prices, as distinct from export unit values, since as was seen earlier, the price series excludes the erratic movements of unit values resulting from shifts in product mix, which could significantly affect the trends in unit values of manufactures exported to different areas. However, the justification for the proposed assumption, being dependent on similar cost conditions in export industries, is not necessarily applicable to manufactured imports, though prices of particular products originating in different countries may well exhibit similar trends, particularly if competitive conditions prevail in the importing country. None the less, there will be certain situations where the 'law of one price' does not hold, for example following a significant change in the exchange rate, when exporters have to take a cut in profit margins in order to remain competitive in a particular import market.

The question that arises is whether deviations from this 'law' are large enough to influence foreign trade prices – as measured by the proposed short-cut method – to a significant extent; and, if so, whether such deviations can be explicitly corrected. These are essentially empirical issues, so that some form of validation of price indices based on the proposed short-cut method would appear essential before they can be accepted as reliable indicators of movement in inter-regional foreign trade prices.

A test for validation.

This test was based on a comparison of the new BLS import price indices mentioned earlier relating to imports of manufactures by 'location of origin' with the corresponding price indices based on the proposed short-cut method. This method used the BLS price indices for imports (from all sources) of 28 2-digit product groups,[5] each weighted by the value of US imports in 1995 from each 'location of origin'. Following BLS practice, the new 'short-cut' indices prepared for this comparison also used the year 1995 as a reference base.[6] The resulting comparisons are depicted in Fig. 1 for total developed and total developing countries, and in Fig. 2 for the four countries or regions; the corresponding price indices are given in Table A.2 (Appendix II).[7]

FIG 1 Import price indices for US imports of manufactures from Developed and Developing Countries
(Indices 1995 = 100)



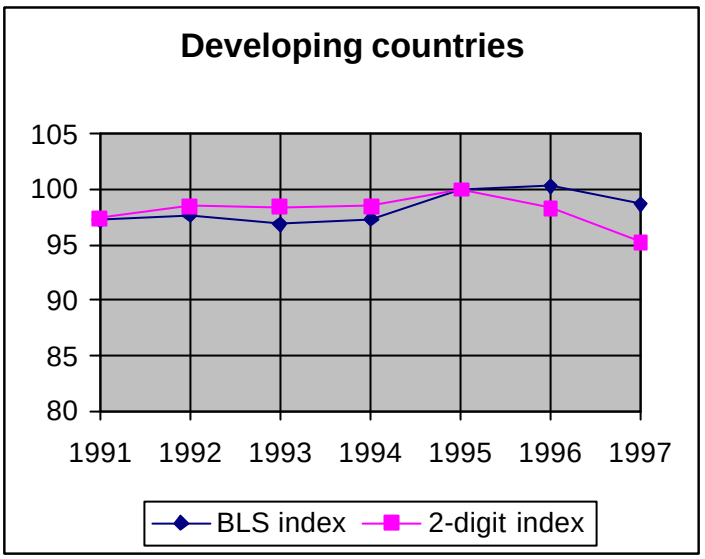
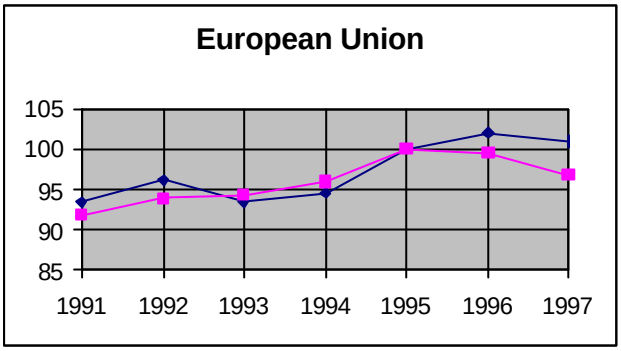
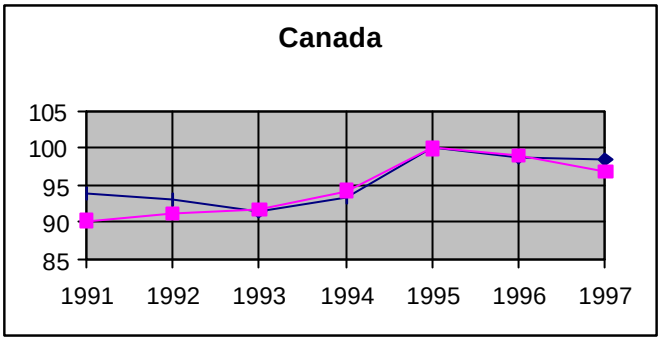
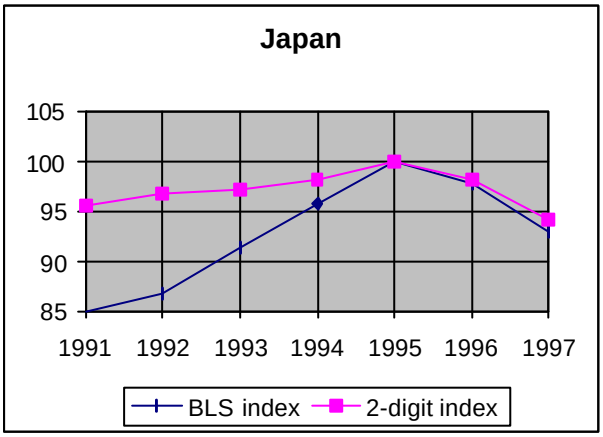
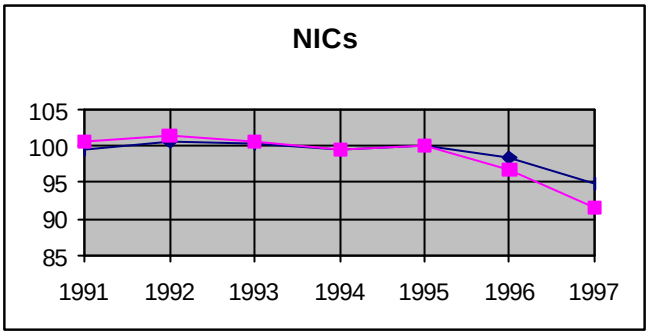


FIG 2 Price indices for US imports of manufactures from selected countries or regions, 1991-97
(Indices 1995 = 100)









The goodness of fit was best for manufactures imports from the European Union and for developing countries as a group, the mean annual difference in each case being 0.3 per cent between the BLS price index and the corresponding 2-digit index, and almost as good for imports from the newly industrialized countries of East Asia (mean annual difference 0.4 per cent). The fit for imports from Canada and from developed countries as a group was less good, with mean annual differences of 0.9 and 1.5 per cent respectively. Exceptionally, for Japan the mean annual difference between the two indices (5.0 per cent) was unacceptably large, the BLS index rising by some 18 per cent from 1991 to 1995, whereas the 2-digit index rose by only about 9 per cent. As indicated earlier, a discrepancy of this kind can arise as a result of a substantial change in the exchange rate of an exporting country's currency, which in turn could also result in differential pricing by exporters to different markets. The sharp depreciation of the US dollar in terms of yen during the first half of the 1990s undoubtedly forced many Japanese exporters to reduce their prices in yen terms in order to protect their market share in the US (as well as elsewhere). Neither of these two factors – the exchange rate change and the extent of price adjustment by exporters – is fully, if at all, taken into account in the 2-digit price index for US imports from Japan.

An indicator of the magnitude of the consequent correction required to the 2-digit price index for Japan can, however, be calculated. First, an index was constructed of the exchange rate of the US dollar per unit of national currency for each country, including Japan, from which the US imports those manufactured goods which comprise the bulk of imports from Japan.[8] These bilateral exchange rates were weighted by the value of US imports in 1995 for each country or country group for the ten most important 2-digit groups in US imports from Japan.[9] This weighted average exchange rate (E_T) is that implicit in the use of the BLS import price indices for individual products at the 2-digit level, whereas the appropriate exchange rate for constructing a valid price index for U.S. imports from Japan would be the dollar/ yen rate (E_J). The 2-digit price index would thus need to be corrected by multiplying that index by the ratio E_J/E_T.

The second correction factor, as indicated earlier, consists of two elements, *viz*. the proportion of Japanese exports to the US subject to 'pricing to market' adjustment (m), and the proportionate reduction in Japanese export prices in yen terms in a period of substantial appreciation in the yen/ dollar exchange rate (π). The full correction factor to the calculated 2-digit price index, combining both exchange rate and price adjustment effects, would then be:

$$(1 - m\pi)E_J/E_T \qquad (1)$$

Though it is not possible to estimate the probable magnitudes of m and π separately, their combined magnitude can be assessed if the corrected 2-digit price index is put equal to the corresponding BLS index. Thus:

$$P_J(1 - m\pi)E_J/E_T = P'_J \qquad (2)$$

where P_J and P'_J denote, respectively, the 2-digit index and the BLS index for US imports from Japan. By rearranging eq. (2) we have:

$$m\pi = 1 - (P'_J/P_J)(E_T/E_J) \qquad (3)$$

The value of $m\pi$ is thus derivative from two ratios of index numbers, so that for any given base year $m\pi$ is necessarily zero.[10] As is shown in Appendix II, the effect of changes in $m\pi$ on the price index for US imports from Japan is more readily seen if the base year is shifted from 1995 to 1991. The value of $m\pi$ then rises from zero in 1991 to 12 ½ per cent (of the exchange rate-adjusted 2-digit price index) in 1994 and 1995, before falling to 4 or 5 per cent in the following two years.[11]

One would expect, *a priori*, that in years when the yen had appreciated considerably against the US dollar, there would be an incentive for Japanese exporters to reduce their prices in yen terms to a greater extent than in years when the yen appreciation was smaller. In other words, the expectation would be for a positive relationship between $m\pi$ and E_J/E_T, which implies a negative relationship between the correction factor $(1-m\pi)$ and E_J/E_T. There was, in fact, such a negative relationship in the period 1991-97 (see Fig. A.2 and Table A.3 in Appendix II), which explains why the value of $m\pi$ rises between 1991 and 1995, when the Japanese exchange rate ratio was increasing, while the reverse relationship held for the following two years.

If the adjustment made to the 2-digit price index for US manufactures imports from Japan is applied also to the corresponding index for US imports from all developed countries, including Japan, then the difference between the 2-digit price index for manufactures imported from all developed countries and the corresponding BLS price index virtually disappears (see Fig. 1 and Appendix II, Table A.4).

This validation test has shown that for the 1991-97 period indices based on weighting the 2-digit BLS price indices for US imports of manufactures by the value of 1995 imports from individual countries or country groups yielded weighted price indices very close indeed to the corresponding BLS indices in four cases (total developing countries, the four NICs, Canada and the EU), while the goodness of fit was not as close for all developed countries, and was unacceptably poor for Japan. However, applying a correction factor based partly on exchange rate changes, both these latter indices were improved to fully acceptable standards.

It would seen reasonable, on the basis of these results, to attempt to extend the US import price indices back in time, while applying the same methodology to derive comparable price series for US exports of manufactures to the same country groups as for imports, so that new series for the terms of trade of developing and developed countries with the US may be derived. The methodology used is set out in detail in Appendix II, while the new price indices, for US trade in manufactures with developing, and with developed, countries are given in Appendix IV.

Trends In The Manufactures Terms Of Trade Of Developing And Developed Countries With The United States

The BLS price indices for manufactures imported and exported by the US use trade values in a particular base year for weighting purposes. The earlier indices used

values for 1969, 1970, 1973, or 1975, all historical series being revised in 1982 to reflect 1980 trade weights (BLS, 1988). The base year was changed to 1985, followed later by 1990 and, most recently, by 1995. The new price indices for US trade in manufactures with other developed countries, and with developing countries, presented below, use essentially the same system of moving base weighting as that used by the BLS, this time using trade values at 5-year intervals – 1980, 1985, 1990, and 1995 – as base years. The indices for the various sub-periods (1981-85, 1985-90, 1990-95 and 1995-97) have then been linked to form a continuous price series with 1981 as the base year.

A summary view of the trends in the values, prices and volumes of US trade in manufactures with developing countries since 1981 is presented in Table 1, and with other developed countries in Table 2. Several of these trends are relevant to the present study. First, a sharp deterioration in the US balance of trade in manufactures occurred over the period since 1981, rather more than one-half of the deterioration being in the exchange of manufactures with developing countries. Second, while other developed countries benefited from an improvement in their terms of trade in manufactures with the US, by 1.0 per cent p.a., the developing countries suffered an average annual terms of trade deterioration of 0.9 per cent. This deterioration, however, occurred entirely in the first half of the 1980s – almost certainly a result of the strong appreciation of the dollar in this period – the manufactures terms of trade of developing countries with the US being trendless after 1985. By contrast, the corresponding terms of trade trend of developed countries was significantly upward after 1985.

For the whole period from 1981, the *relative* terms of trade of developing, compared with those for developed, countries deteriorated by an average rate of 1.9 per cent p.a., almost double the annual rate of deterioration (1.0 per cent p.a.) found by the Sarkar-Singer study (1991: 335) for the manufactures terms of trade of developing countries with all developed countries over an earlier period, 1970-87. Though this latter study used unit value indices, and included intra-regional as well as inter-regional trade, the results summarised in Tables 1 and 2 provide support for the Sarkar-Singer conclusion of relative terms of trade deterioration for developing countries' manufactures exports over the period which they covered.

This sharply divergent experience reflected differences in the trends of US import and export prices in manufactures trade with the two groups of countries. Over the whole period from 1981, US manufactures imported from other developed countries rose at a significantly faster rate than did prices of imports from developing countries (2.8 per cent p.a. as against 1.7 per cent p.a.), whereas US prices of manufactured exports to other developed countries rose more slowly than prices of such exports to developing countries (1.7 per cent p.a. as against 2.3 per cent p.a.). The developing countries were thus caught, in a sense, in a price 'scissors' which resulted in failure to recover to the terms of trade level of the early 1980s.

A third trend was the remarkably fast growth in the volume of US trade in manufactures, particularly with the developing countries. US manufactured imports from these countries expanded in volume terms by 12.3 per cent p.a. over the period, the corresponding increase for imports from developed countries being 5.8 per cent p.a. In both cases, this resulted in a fast increase in the income terms of trade, by

TABLE 1 US trade in manufactures with developing countries, 1981-96

	1981	1982-85	1986-89	1990-94	1995-96
Values			($ bill.)[a]		
US imports	37.7	55.6	105.7	163.2	259.5
US exports	63.2	50.5	66.5	124.0	179.4
Net trade	25.5	-5.1	-39.2	-39.2	-80.1
Prices		(Indices, 1981 = 100)			
US imports	100.0	96.0	109.0	120.0	122.0
US exports	100.0	109.0	120.0	133.0	139.0
NBTT[b]	100.0	88.0	91.0	91.0	88.0
Volumes					
US imports	100.0	154.0	255.0	359.0	564.0
US exports	100.0	73.0	87.0	148.0	204.0
ITT[c]	100.0	135.0	233.0	325.0	493.0

Sources:
Bureau of Labor Statistics (1997 and monthly updates), Department of Labor, Washington D.C.; UN COMTRADE data base.

[a]Annual averages

[b] Net barter terms of trade of developing countries with the US

[c] Income terms of trade of developing countries with the US

TABLE 2 US trade in manufactures with developed countries, 1981-96

	1981	1982-85	1986-89	1990-94	1995-96
Values	($ bill.)[a]				
US imports	110.3	146.2	232.6	280.3	369.8
US exports	88.4	86.5	125.2	198.6	257.2
Net trade	-21.9	-59.7	-107.4	-81.7	-112.6
Prices	(Indices, 1981 = 100)				
US imports	100.0	100.0	125.0	138.0	151.0
US exports	100.0	106.0	114.0	125.0	130.0
NBTT[b]	100.0	95.0	109.0	111.0	116.0
Volumes					
US imports	100.0	132.0	169.0	184.0	222.0
US exports	100.0	93.0	124.0	180.0	223.0
ITT[c]	100.0	125.0	185.0	204.0	257.0

Sources: As for Table 1

[a] Annual averages

[b] Net barter terms of trade of developed countries with the US

[c] Income terms of trade of developed countries with the US

about 11.7 per cent p.a. for developing countries, and 7.0 per cent p.a. for developed countries.

For developing countries, the (net barter) terms of trade deterioration from the 1981 level resulted in a substantial negative effect on their manufactures trade balance with the US, this effect averaging -$7.3 billion p.a. from 1981 to 1989, then rising to -$10.3 billion p.a. in the early 1990s and to -$16.3 billion p.a. in 1995-96. By contrast, developed countries benefited from a growing terms of trade gain, from -$5.0 billion p.a. in the early 1980s to about $10 billion p.a. in the following decade, and to some $20 billion p.a. during 1995-96 (Table 3). Taking the period as a whole, the terms of trade loss for developing countries, on the measure used here, amounted to over $140 billion, while developed countries benefited from a terms of trade gain of $115 billion.

For both groups of countries, however, the terms of trade had only a relatively small impact on changes in their manufactures trade balances with the US. For developing countries, the dominant factor was the sharp expansion in the volume of their manufactures exports; for developed countries, the volume growth, while not so dominant, was still the major element in the improvement in their trade balance with the US in manufactured goods.

Trade structures

The differences in trends between developing and developed countries in the prices of their manufactures trade with the US reflect – by construction – differences in the product structures of the trade of the two groups of countries. The major portion of the difference in the trend in prices of US imports as between developing and developed country sources arose during the decade 1985-95, so that some insight into the effects of differences in trade structures can be gained by relating those differences to price changes over that decade.

(a) US imports

Over the decade to 1995 the product composition of US imports of manufactures was significantly different as between imports from developing, and those from developed, countries. Table 4 lists the ten 2-digit groups which contributed the most to the rise in US import prices over this period, showing for each product group the relevant import price index and also the percentage contribution of each group to the rise in the import price index for manufactures as a whole. These ten product groups accounted for over 80 per cent of the rise in the total manufactures import price index for developing countries, and for over 70 per cent in the corresponding index for developed countries.

One major difference in product composition is the dominance of automobiles and machinery in US imports from developed countries, groups which together accounted for over one half of the overall price rise. By contrast, easily the largest group by value among imports from developing countries was clothing, accounting for almost 20 per cent of the total in the base period but, owing to the relatively small price increase since 1985 for this group, it contributed only 16 per cent to the overall price rise. Excluding clothing, the price increase for the remaining nine groups listed

TABLE 3 Decomposition of Changes in the Trade Balance in Manufactures of developing and developed countries vis-à-vis the United States 1981-96[a]

	Change from 1981 to:			
	1982-85	1986-89	1990-94	1995-96
Developing countries		($ billion, annual averages)		
Price effects:				
Terms of trade	-8.2	-6.4	-10.3	-16.3
Trade balance	1.0	1.7	1.5	2.7
Volume effect	37.8	69.4	73.5	119.3
Total	30.6	64.7	64.7	105.6
Developed countries				
Price effects:				
Terms of trade	-5.0	9.6	11.1	20.8
Trade balance	0.0	14.9	26.4	33.9
Volume effect	42.9	61.1	22.4	36.0
Total	37.9	85.5	59.8	90.7

Sources: Tables 1 and 2

[a]See Appendix III for the decomposition formulae used.

would have been 56 per cent over the decade instead of the 46 per cent for all ten groups.

Among US imports from developed countries, three product groups (72 – specialist machinery, 73 – metal-working machine tools, and 74 – non-electric machinery) had similar high price increases, exceeding 80 per cent, over the decade. Excluding these three groups, the price increase for the other groups listed in Table 4 would be reduced to 55 per cent, virtually the same as for US manufactures imports from developing countries if clothing is also excluded from the comparison.

The trade in clothing (the greater part of US imports originates in East and South-East Asia) differs from that in automobiles, specialized machinery and machine tools (originating mainly in Europe and Japan) in several respects. First, whereas specialized machinery generally embodies 'high-tech' processes in developed countries, usually protected by patents, clothing production in developing countries is 'low-tech' in so far as it is based on mature technology not covered by patent protection. Second, the production of specialized machinery necessarily involves the use of skilled labour, in contrast to the position in clothing production which depends heavily on low-wage semi-skilled workers. Third, the market for specialized machinery is often characterized by temporary 'rent' which manufacturing enterprises can charge on the provision of new technology, as well as by the use of oligopolistic power, especially when such enterprises control patented processes allowing them to sell their output on a 'cost plus' basis. The international market for clothing, by contrast, is largely supplied by relatively small firms in developing countries having little or no market power to influence prices in the importing countries.

These interrelated differences in technology levels, labour skills, wage rates and market power would appear to be probably the major influences behind the greater rise in the prices of manufactures imported by the US from other developed countries than those imported from developing countries over the decade up to 1995.

(b) US exports

Two distinct differences can be discerned between the price increases for the various product groups exported from the US over the decade 1985-95 (Table 5), and the corresponding price increases for US imports (Table 4).

First, for the major product groups, such as automobiles and specialized machinery, the rise in import prices over the decade was more than double the corresponding rise in export prices, and this disparity held for US trade with both developing and developed countries.

Second, there appears to have been a much smaller dispersion in price increases among the various product groups exported by the US over the period covered, compared with the price dispersion for US imports. The difference in price dispersion can conveniently be quantified by calculating the coefficient of variation (ie the ratio of the standard deviation to the mean) for all the 2-digit groups for which the relevant price series are available (27 series for US imports, and 22 series for US exports). Over the decade to 1995, the coefficient of variation was 0.17 for US imports, and

TABLE 4 Contribution to US import price increase, 1985-95, by major product group

Imports from developing countries					Imports from developed countries			
SITC group	Principal products	1995 price index (1985=100)	Contrib[n] to price increase[a] (%)		SITC group	Principal products	1995 price index (1985 = 100)	Contrib[n] to price increase[a] (%)
74, 77[b]	Electrical machinery	167	19.3		78	Automobiles, parts & accessories	154	29.9
89	Toys, sports goods	155	16.8		72, 73 74, 77[b]	Machinery, electric and non- electric	177	25.3
84	Clothing	126	15.8		89	Toys, sports goods	155	5.2
85	Footwear	142	8.2		64	Paper and board	152	3.2
78	Automobiles, parts & accessories	154	6.0		68	Non-ferrous metals	153	3.0
69	Base metal goods	150	5.2		67	Iron and steel	138	2.8
65	Textile fabrics	145	4.5		66[c]	Pottery, glassware	188	2.8
66[c]	Pottery, glassware	190	4.0					
68	Non-ferrous metals	153	3.3					
	Total of above	146	83.2			Total of above	160	72.3
	Other manufactures (except IT)	121	18.1			Other manufactures (except IT)	144	28.3
	IT products[d]	96	-1.3			IT products[d]	95	-0.6
	TOTAL	133	100.0			TOTAL	151	100.0
	Total, less IT	138	. . .			Total, less IT	154	. . .

Notes for Table 4

Sources: As for Table 1

[a]Proportion of the increase in the import price index for total manufactures attributable to the price change for individual product groups. This is computed by deducting the base period import value for each product group from the corresponding cross-value (ie the value obtained by multiplying the base period value by the relevant 1995 price index, with base at 1985). For this purpose, the base period value has been taken as the geometric mean of the values for 1985 and 1990, so as to allow for the influence of changing product composition over the period.

[b]Excluding SITC 776

[c]Excluding SITC 667 (pearls and semi-precious stones) which are not strictly manufactured goods

[d]SITC 752, 759 and 776

TABLE 5 Contribution to US export price increase, 1985-95, by major product group

Exports to developing countries				Exports to developed countries			
SITC group	Principal products	1995 price index (1985=100)	Contrib[n] to price increase[a] (%)	SITC group	Principal products	1995 price index (1985 = 100)	Contrib[n] to price increase[a] (%)
71,72,74,77[b]	Machinery, electric and non-electric	131	34.7	71, 72,74,77[b]	Machinery, electric and non-electric	129	30.4
51	Organic chemicals	145	9.1	78	Automobiles, parts and accessories	120	14.3
87	Measuring and controlling instruments	144	6.9	51,54,59	Organic chemicals, medicinal and misc. chemical products	134	11.9
78	Automobiles, parts and accessories	120	5.8	87	Measuring and controlling instruments	144	9.9
76	Telecom equipment	118	3.4	89	Musical instruments, printed matter, works of art	116	4.0
65	Textile fabrics	132	3.0				
89	Plastic articles, musical instruments	116	2.2				
	Total of above	130	65.0		Total of above	127	70.6
	Other manufactures (except IT)	131	42.5		Other manufactures (except IT)	131	45.6
	IT products[c]	85	-7.5		IT products[c]	75	-16.2
	TOTAL	125	100.0		TOTAL	121	100.0
	Total, less IT	128	. . .		Total, less IT	129	. . .

Sources: As for Table 1

[a] See footnote [a] to Table 4 [b] excluding SITC 776 [c] SITC 752, 759, and 776

0.12 for US exports, the latter figure representing 71 per cent of the import price coefficient – a substantial and significant difference.

These two general tendencies have implications for causal explanations. The much smaller price dispersion among exports would seem to indicate that price change in this area is driven largely by internal economic developments within the US, probably focused on productivity growth rates and the rate of increase in domestic inflation. By contrast, the wider price dispersion among US import product groups would seem to indicate the dominance of international factors, such as changes in the relevant exchange rates and differences in productivity and cost trends in the various national sources of supply.

Information technology products

Price trends for imports and exports of manufactures have been significantly influenced by the rapid growth in US trade in I.T. products with both developing and developed countries. US imports of the major I.T. products, which accounted for some 10 per cent of all manufactured imports from developing countries in 1980 and 1985, expanded to 14 per cent in 1990 and to 23 per cent in 1995. The I.T. content of US manufactured exports to developing countries also rose over these years, but at a lower overall rate (Table 6).

The share of IT products in US manufactures trade with developed countries also rose significantly over this period, the major change being a rise from about 5 per cent of US imports in 1985 to 17 per cent a decade later, but there was no significant change in the IT share of US manufactures exports, which remained at 13-14 per cent over that decade. Reflecting these changes, the US trade balance in IT products with developing countries shifted into small deficits in the later 1980s, and into a much larger deficit by the mid-1990s ($30 billion in 1995). The trade in IT with developed countries, which had been in small surplus throughout the 1980s, also shifted into deficit by 1995.

These various shifts in trade patterns involving IT products are of significance in so far as these products have had a quite different price trend from that of other manufactures. The IT price indices for both US imports and US exports have been on downtrends since at least the mid-1980s, with sharp falls being recorded since 1995. By 1997, IT prices had fallen by some 25 per cent compared with the 1985 level for imports from both developing and developed countries, as well as for exports to developing countries, and by a greater fall, of 35 per cent for exports to developed countries. However, since trade in IT products has rapidly become more substantial on both the import and export sides of US trade in manufactures with both developing and developed countries, excluding these products would have only a relatively small effect on the net barter terms of trade of these two groups of countries with the US.

TABLE 6 US trade in major IT products[a], 1980-95

	1980	1985	1990	1995
Trade with developing countries		($billion)		
Imports	3.1	6.9	18.0	57.2
Exports	3.8	6.2	11.6	27.0
Net trade	0.7	-0.7	-6.4	-30.2
As propn of total trade in manufactures		(per cent)		
Imports	9.7	10.0	13.9	22.9
Exports	6.6	12.6	12.5	15.7
Trade with developed countries		($billion)		
Imports	2.2	8.9	19.9	43.1
Exports	8.1	12.9	23.7	33.1
Net trade	5.9	4.0	3.8	-10.0
As propn of total trade in manufactures		(per cent)		
Import	2.2	4.7	10.7	17.2
Exports	9.6	13.9	12.8	13.2

Source: UN COMTRADE data base

[a] Sum of SITC 752 (computer equipment), 759 (computer parts and accessories and office machines), and 776 (transistors, electronic valves and tubes, diodes and integrated circuits).

Conclusion

This paper provides a new set of price indices for the trade in manufactures between developing and developed countries on the one hand, and the United States on the other. These indices show that over the years 1981-96 the net barter terms of trade of developing countries showed a significant deterioration in the first half of the 1980s and has been trendless since then, while the terms of trade of developed countries, which had been trendless in the first half of the 1980s, has shown a significant upward movement thereafter. Over the whole period, the relative terms of trade trend of developing countries, compared with that of developed countries, has significantly worsened.

A decomposition analysis of the change over the period in the balance of manufactures trade of developing, and of developed, countries with the US showed clearly that the dominant element has been an exceptionally rapid growth in the volume of trade, which accounted for over four-fifths of the improvement in the manufactures trade balance of developed countries with the US from 1981 to 1986-89, and for two-thirds of the improvement from 1981 to the first half of the 1990s. for the developing countries, the volume expansion has been even greater, and was offset only to a minor extent by the adverse effects of price trends in the manufactures trade balance.

A more detailed analysis by major product groups revealed significant differences in US imports from developed, as compared with developing, countries. Whereas automobiles and machinery were dominant among imports from developed countries – with machinery recording a high price increase over the period – the largest product group among imports from developing countries was clothing, for which the price rise since 1985 was relatively small. These and related differences indicate that whereas 'high-tech' products are of major importance in developed country exports to the US, supplies from developing countries have a significantly larger 'low-tech' content. Equally, while developed country products such as specialized machinery necessarily involve the use of skilled labour, clothing industries in developing countries depend largely on low-wage semi-skilled labour. Finally, whereas the market for specialized machinery reflects considerable oligopolistic power, that for clothing is largely supplied by relatively small firms having little or no influence on world prices.

What are the implications of these and other findings presented here for the hypothesis advanced by Singer (1971), and referred to earlier, that developing countries are likely to face a deterioration in their manufactures terms of trade *vis-à-vis* developed countries, since the latter have a near-monopoly of technological innovation, and can, in effect, determine both the direction of technical progress in developing countries and access to the relevant information necessary for successful bargaining?

When this hypothesis was advanced, in the early 1970s, the assumption that manufacturing firms in developed countries had a near-monopoly of technological innovation was undoubtedly a correct one. However, major changes in the capability of developing countries have taken place since then, particularly as regards IT products. One important change has been the emergence of industries in many developing countries in East and South-East Asia for the production and export of a range of 'high-tech' products, including computers and other electronic goods. Though in some of these countries, such as Malaysia, the operation is essentially one of assembling imported intermediates, in several others, including in particular South Korea and Taiwan, domestic producers have themselves become technological innovators, no longer heavily dependent on foreign transnationals for up-to-date technology and know-how. The strict division between an innovating 'North' and a technology-dependent 'South' clearly does not now apply to the major developing country exporters of 'high-tech' manufactures.

The second clear exception to the Singer hypothesis of 1971 is the fall in IT product prices, even though these are technologically advanced manufactures, whereas the implication of that hypothesis is that such manufactures would command prices which include an element of 'excess' profit because of the near-monopoly held by developed country producers. It may be that the IT industry is the only large exception to a general rule because of its unprecedented rate of technological innovation, the relative ease of establishing new small-scale production facilities using the latest techniques, and the consequent difficulties even of large producers to achieve a near-monopoly position. To the extent that this type of product continues growing in importance in the future relative to total world manufactures exports, the IT product exception to the original Singer hypothesis would become even more important.

A further finding of the present study is that over the decade up to 1995 – which accounted for the greater part of price increases since 1981 – the relative dispersion of price increases among the various product groups was significantly smaller for US exports than for US imports. This difference would appear to indicate that whereas changes in US export prices are driven largely by domestic economic developments – probably focused on growth rates of productivity and inflation – the wider price dispersion among US import product groups would indicate the dominance of international factors, such as changes in the relevant exchange rates and differences in productivity and cost trends in the various national sources of supply.

Finally, three important limitations of the present analysis should be mentioned. First, international trade in the period covered was clearly substantially influenced by large movements in exchange rates of the principal trading currencies, and a simulation of terms of trade trends assuming no exchange rate changes would have been desirable. Second, the period covered – only 17 years – is really too short to yield a long-term trend. The trends presented in this paper should be taken, rather, as medium-term trends which, none the less, provide some insights into the longer-term forces influencing the secular trends in US trade in manufactures with developing and developed countries. And, third, it did not prove possible within the limited resources available to include a detailed analysis of the trade trends in manufactures among the developing countries themselves.

APPENDIX I The use of SITC 2-digit price indices

The various new import and export price indices presented in this paper are all based – with one exception (see below) – on SITC 2-digit price series published by the US Bureau of Labor Statistics (BLS), in the Detailed SITC Historical Tables of the Bureau's 'International Price Program', with regular monthly updates. These price series are available at both the 2-digit and 3-digit levels.

The 3-digit series would normally be preferable as a basis for any attempt at measuring price trends in inter-country trade, since the greater disaggregation of products would allow a more appropriate concordance with the particular set of products traded by the US with different countries. However, compiling the new price series on the 3-digit basis would have involved a major disadvantage, namely that the 3-digit price series taken together have a substantially smaller coverage of US foreign trade than the 2-digit series, because price series are not separately published for a large number of 3-digit headings.

As Table A.1 shows, though there are significantly more 3-digit price series for US imports (39 as against 28 for the 2-digit series after the mid-1980s), the proportion of the value of manufactures imported from developing countries covered by the 3-digit series was substantially lower than for the 2-digit ones. Exceptionally, for the Machinery and Transport group (SITC 7), the coverage of the 3-digit series was reasonably high – over 75 per cent for the period after 1985, as against almost 95 per cent for the 2-digit series.

To test whether the greater product detail provided by the 3-digit series for group SITC 7 more than offsets the lower coverage compared with the 2-digit series, a separate price index for US imports of SITC 7 was constructed for the period 1985-97 from the 3-digit data for comparison with the 2-digit series. This showed that while the two indices were virtually identical with each other, and with the corresponding BLS index, from 1985 to 1989, significant differences appeared thereafter. For the 2-digit series, the annual average price index for 1990-97 fell short of the BLS index by 2.1 per cent, but for the 3-digit index the shortfall was 4.2 per cent. As a result, the further analysis was based on the 2-digit series, with one important exception, *viz.* Information Technology products, for which it was necessary to use the aggregate of the following 3-digit headings: 752 (computers), 759 (parts and accessories for computers and office machines), and 776 (transistors, valves, etc).

TABLE A.1 Coverage of BLS price indices for US imports of manufactures from developing countries

	No. of price series		Coverage of price indices	
SITC	1980	1985-95	1980	1985-95
Section 7:			(per cent)	
2-digit	7.0	7.0	93.9	94.1
3-digit	12.0	19.0	67.2	77.2
Sections 5,6 and 8:				
2-digit	18.0	21.0	86.9	97.6
3-digit	15.0	20.0	22.8	26.5
Total: 2-digit	25.0	28.0	89.0	96.3
3-digit	27.0	39.0	36.4	48.0

Sources: US Bureau of Labor Statistics (1997); UN Comtrade data base

APPENDIX II: Correction factors for the 2-digit price indices

Table A.2 gives the 2-digit import price indices for the various 'location of origin' countries or regions, together with the corresponding BLS indices. As mentioned in the text, there was an unacceptably large difference between the 2-digit price index for US imports from Japan and the corresponding BLS index. It was argued in the main text that this difference arose from two related factors, *viz*. a sharp depreciation of the exchange value of the US currency in terms of yen, and as a consequence of this depreciation, some reduction in Japanese export prices in yen terms to protect market share.

A correction factor to allow for the effects of the dollar/ yen depreciation, assuming no consequential reduction in yen prices of Japanese exports, can be calculated by relating an index of the dollar/ yen exchange rate to a weighted average index of the dollar/ national currencies exchange rate of each country, including Japan, from which the US imports those manufactures goods which comprise the greater part of US imports from Japan. In 1995, the base year for the calculation, ten 2-digit groups[12] accounted for 87 per cent of total manufactures imported by the US from Japan, while eight countries, including Japan, accounted for over 80 per cent of the value of US imports of these ten product groups from all countries. An index of the value of the US dollar in terms of the national currencies of the eight major supplying countries was weighted by the value of US imports of the specified ten 2-digit groups from each country to derive a composite exchange rate. The required correction factor was then arrived at by expressing the dollar/ yen rate (E_J) as a ratio of the composite rate (E_T).

The probable magnitude of the second factor affecting the divergence between the 2-digit price index for US imports from Japan and the corresponding BLS index can be assessed by changes in the ratio of the latter index (P'_J) to the exchange rate-corrected 2-digit index ($P_J.E_J/E_T$). As explained in the main text, this ratio is equal to $(1-m\pi)$, where m = the proportion of US imports from Japan subject to some price reduction in yen terms, while π = the mean price reduction made.

The relationships involved can perhaps be more easily seen if the reference base is moved to 1991, the first year of the comparison. The value of the correction factor $(1-m\pi)$ is then seen to decline from 100 per cent in 1991 to under 88 per cent in 1994 and 1995, before rising again to 95-96 per cent in 1996 and 1997 (Table A.3 and Fig. A.1).

TABLE A.2 Composition of BLS import price indices[a] with indices based on 2-digit series

(Indices, 1995=100)

	Developed Countries		Developing Countries		Canada	
	BLS	2-digit	BLS	2-digit	BLS	2-digit
1991	89.1	92.9	97.2	97.4	93.9	90.3
1992	90.5	94.1	97.7	98.5	93.2	91.3
1993	92.0	94.4	96.9	98.4	91.6	91.7
1994	94.7	96.2	97.3	98.5	93.4	94.3
1995	100.0	100.0	100.0	100.0	100.0	100.0
1996	99.6	99.2	100.3	98.3	98.9	99.1
1997	96.9	96.1	98.7	95.2	98.5	97.0

	European Union		Japan		NICs[b]	
	BLS	2-digit	BLS	2-digit	BLS	2-digit
1991	93.3	91.9	84.8	95.6	99.6	100.6
1992	96.2	93.9	86.7	96.8	100.5	101.3
1993	93.3	94.3	91.3	97.1	100.2	100.6
1994	94.6	96.0	95.7	98.1	99.5	99.6
1995	100.0	100.0	100.0	100.0	100.0	100.0
1996	102.1	99.5	97.9	98.1	98.5	96.8
1997	100.9	96.9	93.0	94.2	94.9	91.5

Sources: As for Table A.1

[a] The indices for 1991 and 1992 include estimates for those months for which no BLS price indices are available, based on straight line interpolations between the published indices for every third month up to September 1992.

[b] Hong Kong, Republic of Korea, Singapore and Taiwan

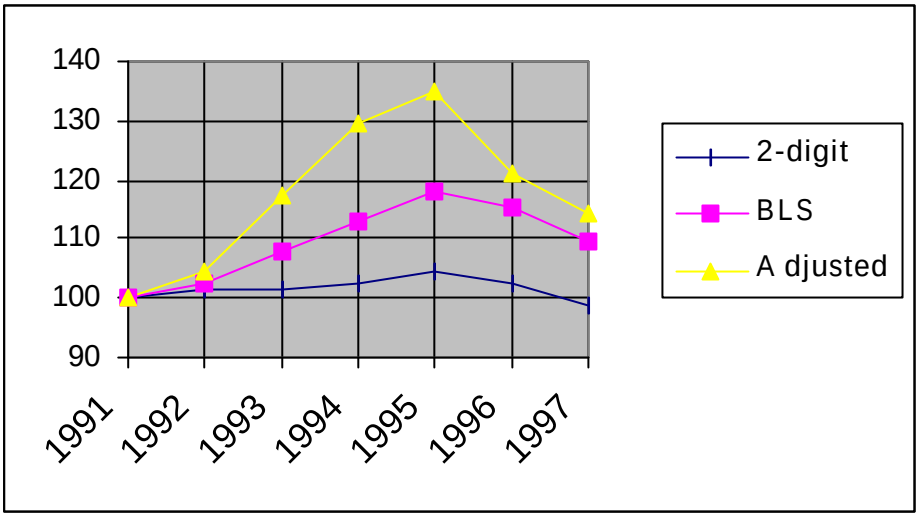
TABLE A.3 Correction factors for 2-digit price index for US imports of manufactures from Japan, 1991-97

(Indices, 1991 = 100)

	BLS index (P_J')	2-digit index (P_J)	Japanese exchange rate ratio (E_J/E_T)	Adjusted 2-digit index	1-mπ
1991	100.0	100.0	100.0	100.0	100.0
1992	102.3	101.3	103.4	104.7	97.6
1993	107.7	101.6	115.7	117.6	91.6
1994	112.9	102.6	126.0	129.3	87.3
1995	117.9	104.6	128.9	134.8	87.5
1996	115.3	102.6	118.1	121.2	95.1
1997	109.7	98.5	115.9	114.2	96.1

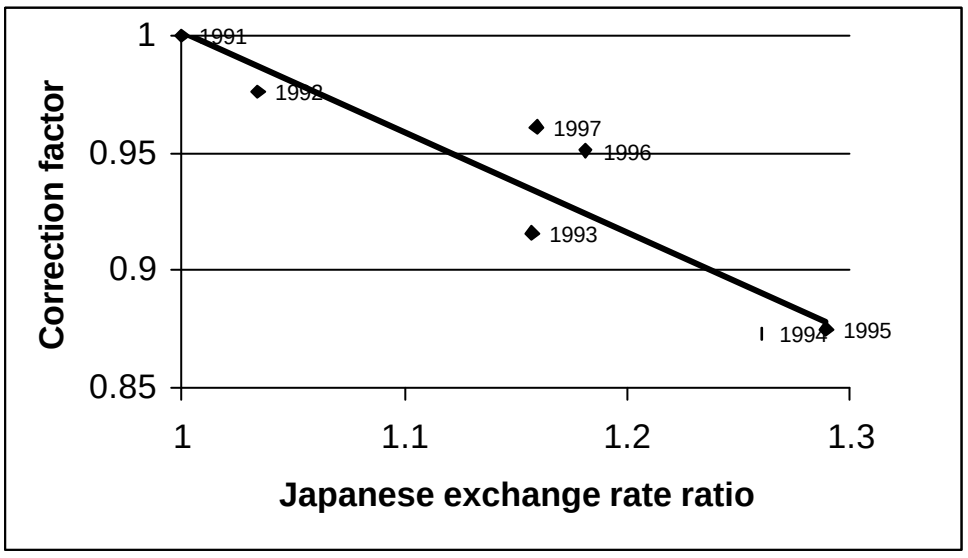
Sources: As for Table A.1

FIG A.1 Price indices for US imports of manufactures from Japan, 1991-97
(Indices, 1991 = 100)



Source: Table A.3

FIG A.2 Relationship between correction factors and exchange rate ratios for Japan 1991-97
(Indices 1991 = 1)



Source: Table A.3

Adjustment to the 2-digit price index for US imports from developed countries

(a) 1991-97

It was mentioned in the text that the 2-digit price index for US imports of manufactures from developed countries was not as good a fit to the corresponding BLS index as was most of the other 2-digit indices over the period since 1991, with the marked exception of the index of imports from Japan. The question that arises is whether, and to what extent, the deviation between the 2-digit and BLS indices for Japan has affected the 2-digit index for developed countries as a whole. This issue can be determined as follows.

The deviation between the two indices for US imports from Japan is $P'_J - P_J$, using the earlier notation. This can then be converted into the corresponding cross-value, in terms of values in the base year (1995), by multiplying $P'_J - P_J$ by the value of US manufactures imports from Japan in that year ($124.4 billion). For ease of reference, the indices and cross-values have been rebased to 1991, the first year of the validation exercise. For 1995, the year of peak prices for US imports from Japan, there was a deficiency of $16.5 billion in the cross-value. If this sum is then added to the corresponding 1995 cross-value for US imports of manufactures from all developed countries, the adjusted cross value is increased to $383.1 billion, equivalent to a price index for that year of 112.5 (1991=100), which is virtually identical to the 1995 BLS index. Table A.4 sets out the calculations for each year from 1991 to 1997.

(b) 1985-91

A similar procedure was followed so far as possible for the 2-digit price index for US imports of manufactures from developed countries over the period 1985-91, during which the exchange value of the US dollar had been deteriorating, particularly against the yen. Over the four years 1985-88, the yen exchange rate ratio (i.e. the $/ yen exchange rate as a ratio of the weighted exchange rates of those countries supplying the manufactures comprising most of the US imports from Japan) rose by 25 per cent, almost the same increase (26 per cent) in that ratio as in the four years 1991-94 (see Table A.4). The statistical problem, however, is that while for the 1990s an annual correction factor could be calculated by the use of the published BLS price indices for US imports from Japan, for earlier periods there is no such 'location of origin' series.

One approach to meeting this problem – and the one used here – would be to utilise the close negative relationship found earlier between the correction factor ($1-m\pi$) and the Japanese exchange rate ratio (see Fig A.2). If the assumption is made that this relationship for the 1990s also held for the second half of the 1980s, then annual correction factors can be calculated for the latter period from the movement in the Japanese exchange rate ratio. The results (Table A.5) show an increase of 38 per cent in US price of manufactures imported from Japan from 1985 to 1990, as against 30 per cent for the 2-digit index.[13]

For each year, the difference between these two price indices can be converted into cross-values, by multiplying the difference by the value of US imports of manufactures from Japan in the base year 1985 ($70.8 billion). The result indicates

TABLE A.4 Adjustment to 2-digit price index for US imports of manufactures from developed countries, 1991-97

	Imports from Japan		Imports from developed countries[a]			
	$P_J' - P_J$	Cross-value deficit	2-digit cross-value	Adjusted 2-digit cross-value	Adjusted 2-digit price index	BLS price index
	(1991=100)		($billion)		(1991= 100)	
1991	0.0	0.0	340.6	340.6	100.0	100.0
1992	0.9	1.1	345.0	346.1	101.6	101.6
1993	6.1	7.6	346.1	353.7	103.8	103.3
1994	10.3	12.8	352.7	365.5	107.3	106.3
1995	13.3	16.5	366.6	383.1	112.5	112.2
1996	12.7	15.8	363.7	379.5	111.4	111.8
1997	11.2	13.9	352.3	366.2	107.5	108.8

Sources: As for Table A.1

[a]Including Japan

the deficit in the cross-value for imports from Japan, which can then be added to the 2-digit cross-value for US imports from developed countries as a whole. The adjusted price index for US manufactures imports from all developed countries then rises by 34 per cent from 1985 to 1990, as against 31 per cent for the 2-digit index (Table A.6).

These adjusted US import price indices need some verification, bearing in mind the use of estimates for the value of the correction factor (1-mπ). This can be done at the global level, by comparing a weighted average of the 2-digit price indices for US imports of manufactures from developing and developed countries with a price index for US imports of manufactures from the world. This latter index has been based on the 1-digit price series (for SITC 5,6,7 and 8) published by the BLS. The various results can now be concisely summarised, as follows, for the period 1985-95:

Imports from	2-digit		2-digit adjusted		1-digit (BLS)	
	1990	1995	1990	1995	1990	1995
			(price indices 1985=100)			
Developing	127	133	127	133	. . .	. . .
Developed	131	144	134[a]	153[a]	. . .	. . .
Total	130	141	132	146	132	145

[a] Price indices for imports from developed countries, adjusted for underestimates for Japan (see Tables A.4 and A.6)

While the adjustment for imports from Japan from 1985 to 1990 on the 2-digit basis yielded a total price index for developing plus developed countries which exactly equalled the 1-digit BLS total, for the subsequent period, 1990-95, the corresponding adjustment appears to have been slightly excessive (by under 1 per cent). A downward adjustment of the 1995 price index for imports from developed countries has therefore been made, from 153 to 151, which yields an index of 145 for total imports of manufactures in that year, the small deduction being 'tapered' back to zero in 1990.

(c) 1981-85

During the first half of the 1980s the US dollar appreciated strongly against other major currencies, though exceptionally the appreciation against the yen was relatively small – under 10 per cent during this period. It seems improbable that exporters to the US would have cut their export prices in domestic currencies when the dollar prices of these exports were falling. For this reason, the 2-digit import price indices have been accepted without making any adjustment for 'pricing to market'[14]

The 2-digit price indices for US exports

Unlike the position for the import price indices which had complications resulting from large movements in exchange rates, the 2-digit price indices for US exports to developing and developed countries gave fairly close approximations to the BLS indices for exports to all countries.

TABLE A.5 Estimated correction factor for 2-digit price index for US imports of manufactures from Japan, 1985-91

	2-digit index (P_J)	Exchange rate ratio	Adjusted 2-digit index	Estimated $(1-m\pi)$ [a]	Corrected index (P_J^c)
	(Indices, 1985 = 100)				
1985	100.0	100.0	100.0	100.0	100.0
1986	109.7	116.4	127.7	93.2	119.0
1987	118.2	120.2	142.1	91.8	130.4
1988	126.0	125.3	157.9	89.9	142.0
1989	128.2	119.3	152.9	92.2	141.0
1990	129.5	111.7	144.7	95.0	137.5
1991	131.6	117.0	154.0	93.0	143.2

Sources: As for Table 1; Fig A.2

[a] Derived from OLS regression of $(1-m\pi)$ on E_J/E_T, as shown in Fig A.2, ie $(1-m\pi) = 1.37 - 0.37\ (E_J/E_T)$

TABLE A.6 Adjustment to 2-digit price index for US imports of manufactures from developed countries, 1985-91

	Imports from Japan		Imports from Developed countries[a]			
	PJ' – PJ	Cross-value deficit	2-digit index	2-digit cross value	Adjusted cross-value	Adjusted price index
	(1985 = 100)	($ bill)	(1985 = 100)	($billion)		(1985 = 100)
1985	0.0	0.0	100.0	188.2	188.2	100.0
1986	9.3	6.6	109.2	205.5	212.1	112.7
1987	12.2	8.6	117.6	221.3	229.9	122.2
1988	16.0	11.3	125.4	236.0	247.3	131.4
1989	12.8	9.1	127.9	240.7	249.8	132.7
1990	8.0	5.7	130.7	246.0	251.7	133.7
1991	11.6	8.2	132.6	249.6	257.8	137.0

Sources: As for Table A.1; Table A.5
[a]Including Japan

The relevant comparisons are shown below:-

	2-digit		1-digit (BLS)	
	1990	1995	1990	1995
Exports to:		(price indices, 1985=100)		
Developing	113.2	121.2	. . .	. . .
Developed	112.1	117.9	. . .	. . .
Total	112.5	119.0	113.4	122.4

For total US exports, the ratio of the BLS index to the 2-digit index was 1.008 for 1990 and 1.029 for 1995. Adjusting the 2-digit indices by these ratios, the adjusted 2-digit indices (1985=100) become:

To:	1990	1995
Developing	114.1	124.7
Developed	113.0	121.3
Total	113.4	122.4

The percentage adjustment to the indices for 1995 has been tapered back to zero in 1990.

APPENDIX III Decomposition formulae for changes in trade balance

Text Table 3 shows the relative magnitudes of the effects of price and volume changes on the trade balances of developing and developed countries with the United States over the period 1981-96. The calculations involved are, in effect, a special case of an index number problem. As for all such problems in economic statistics, there is no unique solution, since different weighting systems will yield different results. While, in principle, there are several alternative weighting procedures possible, in practice the selection of the weighting system used for Table 3 was limited since it had to use the chained base-weighted price indices derived from the published BLS data, as described in some detail in Appendix II. Thus, the price effects on changes in the trade balance were calculated for each quinquennium separately, using the trade values of the first year as 'base' weights.

The volume effects were then calculated by the use of the last year in each quinquennium as weights, since this ensured that the price and volume effects added exactly to the trade balance change. The price and volume effects for the various periods were then linked to form continuous series beginning with 1981.

The formulae

Two distinct price effects and one volume effect are distinguished. Apart from the terms of trade effect, there is also a price effect on the trade surplus or trade deficit, which measures the effect of changes in the *level* of prices, whereas the terms of trade effect measures the effect of changes in the *relative* magnitude of changes in import and export prices.

The formulae used are:

(1) Terms of trade effect

$$= V_o^m \, (P^x - P^m)$$

where V_o^m = value of imports from the US in the base year (taken as equal to the value of US exports in that year), and P^x and P^m are, respectively, base weighted price indices for exports to the US and for imports from the US, with base prices = 1.

(2) Trade balance effect

$$= B_o \, (P^x - 1)$$

where B_o = trade balance with the US in the base year of each quinquennium.

(3) Volume effect

$$= (V_1^x - V_o^x P^x) - (V_1^m - V_o^m P^m)$$

where V_1^x and V_1^m = value of exports to, and imports from, the US, respectively, in a later year, while V_o^x and V_o^m = the corresponding trade values in the base year.

The total of three effects is then $B_1 - B_o$.

APPENDIX IV Annual price, volume and terms of trade indices for US trade in manufactures, 1981-97

TABLE A.7 US trade in manufactures with developing countries

	Price Indices			Volume Indices		
	US imports	US exports	NBTT[a]	US imports	US exports	ITT[b]
	(Indices 1981=100)					
1982	98.0	105.5	92.9	106.4	85.0	98.8
83	96.9	107.3	90.3	133.8	69.0	120.8
84	95.8	110.3	86.9	180.6	70.5	156.9
85	93.3	112.4	83.0	194.9	69.5	161.8
86	99.3	113.3	87.6	213.6	70.0	187.1
87	106.7	116.8	91.4	250.7	76.8	229.1
88	113.5	122.5	92.7	272.9	95.4	253.0
89	116.3	126.1	92.2	284.5	107.4	262.3
90	118.8	128.2	92.7	288.2	114.5	267.2
91	119.1	131.3	90.7	301.3	131.2	273.3
92	120.8	133.6	90.4	347.0	151.4	313.7
93	121.0	133.8	90.4	391.7	163.5	354.1
94	121.7	135.7	89.7	464.4	178.3	416.6
95	123.7	140.2	88.2	535.0	193.4	471.9
96	120.5	138.6	86.9	592.1	214.3	514.5
97	115.4	136.8	84.4	. . .	. . .	. . .

Source: Appendix II

[a] Net barter terms of trade of developing countries in exchange of manufactures with the United States

[b] Income terms of trade of developing countries in exchange of manufactures with the United States

TABLE A.8 US trade in manufactures with developed countries

	Price Indices			Volume Indices		
	US imports	US exports	NBTT[a]	US imports	US exports	ITT[b]
	(Indices 1981=100)					
1982	99.9	103.5	96.5	100.2	86.5	96.7
83	99.9	104.7	95.4	109.7	89.0	104.7
84	100.0	106.5	93.9	149.8	97.3	140.7
85	99.9	107.8	92.7	170.7	97.3	158.2
86	112.7	109.1	103.3	171.3	99.5	177.0
87	121.9	111.5	109.3	165.7	113.2	181.1
88	131.0	116.2	112.7	168.5	133.8	189.9
89	132.5	119.7	110.7	172.0	147.3	190.4
90	133.9	121.8	109.9	172.7	172.2	189.8
91	135.7	124.3	109.2	168.2	176.1	183.7
92	137.6	125.9	109.3	177.0	175.9	193.5
93	139.5	125.5	111.2	190.3	177.5	211.6
94	143.3	126.9	112.9	210.7	197.4	237.9
95	150.9	130.8	115.4	220.2	216.5	254.1
96	150.4	129.7	116.0	224.7	230.4	260.7
97	146.3	128.5	113.9	. . .	. . .	. . .

Source: Appendix II

[a] Net barter terms of trade of developed countries in exchange of manufactures with the United States

[b] Income terms of trade of developed countries in exchange of manufactures with the United States

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NOTES

[1] However, for many complex products, substitution of one product for another may not necessarily solve the problem of measuring quality change. A more meaningful approach is the calculation of hedonic price indices based on multiple regressions using key technical characteristics as independent variables. Such hedonic price indices have been derived for various types of machinery, computers and other complex manufactures produced in the US, but are not yet available over the whole range of manufactures in that country, or at all in other countries. (For a comprehensive review of the methodology involved, see Kravis and Lipsey, 1971, Ch.5)

[2] EUROSTAT uses trade data at the CN 8-digit level, and has developed statistical tests to reject items with excessive short-term unit value fluctuations (EUROSTAT, 1992).

[3] For Japan and the NICs, these series relate to total imports by the US. These import price series by 'location of origin' begin in December 1990, continue with indices every third month until September 1992 and are monthly thereafter. A new series for US import prices for manufactured goods from Latin America was begun as from December 1997.

[4] At the beginning of the 1990s, the BLS indices were based on price data for some 23,000 items in its quarterly sample, and about 4,000 items in its smaller monthly sample (Alterman, 1991:113-4)

[5] The reasons for using the 2-digit, rather than the 3-digit, BLS price indices as the basis for the short-cut method are discussed in Appendix I.

[6] For years prior to 1995, the short cut formula used was, for each supplying country or region:

$$P_0/P_1 = \sum_i^n \{P_{0i}/P_{1i}.P_{1i}Q_{1i}\} / \sum_i^n (P_{1i}Q_{1i}) = \sum_i^n (P_{0i}Q_{1i}) / \sum_I^n (P_{1i}Q_{1i})$$

where subscripts 1 and 0 denote 1995 and an earlier year respectively, and i values relate to 2-digit headings. A similar formula was used to compute price indices for years after 1995.

[7] There is a minor discontinuity in the BLS series, since prior to January 1993, manufactures were defined as SITC sections 5-8, while since that date the definition has been based on the Standard Industrial Classification (S.I.C.), Sections 2-3. However, it is not thought that this discontinuity would significantly affect the comparisons of US import price indices for the two large country groups – developing and developed – considered in the present paper.

[8] The countries included are Canada, Japan, European Union, South Korea, Taiwan, Singapore, China and Malaysia.

[9] These ten 2-digit groups accounted for almost 90 per cent of US imports of manufactures from Japan in 1995 (see Appendix II)

[10] The value of $m\pi$, as defined in equation (3) in the text, is not the same as the 'pass-through' rate discussed by a number of analysts in the late 1980s and early 1990s. The latter was designed to show 'to what extent foreign companies may, or may not, have "passed through" into higher dollar prices the changes caused by the exchange-rate fluctuation and to what extent they have absorbed the change, presumably either by lowering costs or lowering profit margins' (Alterman, 1991:130). See also the discussion in Hooper and Mann (1989: 297-337). The pass-through rate would include allowance for changes in production costs and profits in the exporting country, which are not relevant to the calculation of $m\pi$ in the present context.

[11] A similar analysis was not made for US imports from the European Union and Canada, the two other major suppliers of manufactures to the US market, since the effect of the appreciation of the Ecu over the period covered here approximately cancelled out that of the depreciation of the Canadian dollar in terms of the US currency.

[12] Of these, groups 75, 77, and 78 (mainly Information Technology products and passenger road vehicles) accounted for 57 per cent of the total. The other groups included are 71, 72, 74 and 76 (mainly machinery and telecom equipment) and 87, 88 and 89 (measuring instruments, cameras, watches, plastic products etc).

[13] It is of some interest to note that Lipsey et al (1991) found that from 1985 to 1988 there was a fall of 14 per cent in the export/ domestic price ratio for export goods in Japan, suggesting 'that there must have been a very large decline in relative export margins on export' (Lipsey *et al*: 163)

[14] The Japanese export/ domestic price ratio for export goods fell by less than 1 per cent from 1980 to 1985, according to Lipsey *et al* (1991: 162), which supports the argument in this section of Appendix II.