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TARIFF ESCALATION AND ENVIRONMENT

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FOREWORD

This document is a consolidation of two papers presented to the Joint Session of Trade and Environment Experts at its meeting of 3-5 June 1996, as part of the OECD work programme on Trade and Environment. The papers were based on work prepared by Dr. Raed Safadi of the Trade Directorate and Dr. Joy Hecht, a consultant, under the supervision of Crawford Falconer and Jan Adams. This consolidated text is published as a general distribution document under the responsibility of the Secretary General of the OECD with the aim of bringing information on this subject to the attention of a wider audience.

This document is also available in French.

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TARIFF ESCALATION AND ENVIRONMENT

I. Introduction

Some writers on the environmental impacts of trade policy have suggested that tariff escalation is a source of environmental harm to exporting countries (French 1993, Repetto 1994, WTO 1995). "Tariff escalation" refers to a pattern of import duties which rise with the level of processing. The argument of those opposed to such duties on environmental grounds is that escalating tariffs shift the economic activity of exporting countries towards primary production and away from processing. This leads to "excess" extraction of natural resources, with consequent degradation of the resource base. What does the available evidence and literature offer regarding this hypothesis?

In order to address this issue, this paper is structured in the following way:

- Section II discusses the relevance of the practice of tariff escalation to developing countries and traces its potential broad impact on the economy.

- Sections III and IV document the practices of tariff escalation in OECD countries, and examine the structure of OECD tariff barriers. Employing a commodity processing chain classification scheme developed by the World Bank[1], the structure of OECD countries' imports is analysed. Next, using detailed information on trade barriers compiled by the WTO, UNCTAD and the World Bank an attempt is made to determine if these countries' tariffs escalate. Section V refers briefly to tariff escalation in developing countries.

- Section VI reviews some empirical work on sectoral environmental impacts.

- Finally, section VII concludes.

1 (See Box 1 for an example of a commodity processing chain)

II. Tariff escalation and production and trade of developing countries

Theoretical models of the development process and actual plans for industrialisation often assign a key role to trade policy measures. In addition to the maintenance of steady growth in exports and accompanying increases in foreign exchange earnings, developing countries (LDCs) often stress the need to reduce their dependence on traditional primary product exports. Among the factors cited as the underlying reasons for this proposed shift are: (1) the purported deterioration in the terms of trade for primary commodities; (2) the substitution of synthetics for many of these items (plastics for metals, artificial for natural fibers, chemical sweeteners for sugar); (3) the instability of primary product prices in international markets; (4) the increased employment opportunities associated with the production and export of manufactures; and (5) the realisation of economy-wide linkages and learning effects resulting from the processing (manufacturing) function. [2]

One method suggested for increasing the proportion of developing countries' trade in manufactured goods is to increase the processing of natural resource-based products now exported in primary form. However, it has been argued that the structure of tariffs and other trade barriers in major import markets mitigates against that. Specifically, zero or low tariffs have been generally applied to OECD countries' imports of primary (unprocessed) commodities with the duties increasing, or "escalating", as the product undergoes increased fabrication. For example, prior to the Uruguay Round, copra, cotton, castor seed, palm nuts and soybeans have been all imported into some OECD markets duty free. However, once these items were processed into vegetable oils, they encountered average nominal tariffs of 7-9 per cent (Safadi and Yeats, 1994).

Is this of potential relevance to environmental protection? A fully comprehensive discussion of such an issue is beyond the scope of this study. However, some of the key issues involved can be explored.

At the general level, tariff escalation literature suggests that removal of escalating trade barriers is likely to lead to economic growth in developing countries. Attention to environmental issues is known to increase with income.[3] Thus it may be argued that removing tariff escalation could contribute to

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[2] The importance that developing countries attach to trade barrier escalation is reflected in the extensive policy debates on this subject that have occurred in major international forums. For example, developing countries were instrumental in having a statement in the 1982 GATT Ministerial Declaration (p. 16) that "prompt attention should be given to the problem of escalation of tariffs on products with a view to effective action toward the elimination or reduction of such escalation where it inhibits international trade, taking into account the concerns relating to exports of developing countries." The Punta del Este Declaration also stated that "negotiations shall aim to achieve the fullest liberalisation of trade in natural resource-based products, including those in processed and semi-processed forms. The negotiations shall aim to reduce or eliminate tariff and non-tariff measures, including tariff escalation." UNCTAD (1979), Commonwealth Secretariat (1982), World Bank (1981 and 1987) have also viewed tariff escalation as a problem for developing countries. It is also worth noting that while trade barrier escalation has been an issue in the Uruguay Round and previous multilateral trade negotiations (MTNs), the topic's relevance to intra-LDCs trade has not been clearly established. Yet a majority of LDCs have a major interest in promoting further processing of natural resource products that are now often exported in raw or semi-processed form. However, almost all of the empirical studies that have documented the existence of trade barrier escalation have focused on Japanese, North American and European markets and it has not been established whether or not developing countries' trade barriers follow a similar pattern. Some evidence suggests that, despite trade reforms in recent years, trade barrier escalation appears to be more prevalent and severe in LDCs than in OECD countries [see Table 6]. In leather, rubber, textiles and wood, for example, tariffs escalate by 10 to 20 percentage points in more than 80 percent of the LDCs for which data are available (Safadi and Yeats, 1994).

[3] In any particular case, moreover, it would also be necessary to evaluate what the environmental facts would be at the sectoral level. A discussion of a number of these issues is outlined in Section VI below.

increasing the priority of environmental issues for people and governments of raw material producing countries. More specifically, it is argued that the effect of tariff escalation is to bias exports of LDCs towards unprocessed resource-based commodities, on which they earn less in the way of value-added.[4] This would not only limit the resources available to LDCs to pay for better environmental protection, but equally important, it would lead to growing population pressure on marginal resources due to unemployment and poverty.[5]

In addition, it could limit LDCs access to technologies for better environmental management while simultaneously inhibiting their ability not only to innovate and to enhance their productivity in resource use, but also to specialise in sectors where they enjoy comparative advantage, including advantages originating from environmental endowments. A complementary effect in this regard is that LDCs could be denied the opportunity to diversify their exports base while forcing them to depend on a limited number of primary commodities.

There are several studies that have established the existence of a positive relationship between higher growth and greater demands for environmental quality. Key factors that were found explaining this relationship are: high income elasticity of demand for environmental quality, compositional shifts towards cleaner environmental activities at higher income levels, and the extension of property rights combined with the development of policies to deal with global common externalities in more developed economies. There is also empirical evidence in the literature to support the observation that the pollution intensity of economic activities tends to decline as incomes rise. The relationship is encapsulated in the hypothesis that a graphical representation of environment and growth, with environmental degradation measured on the vertical axis and income per capita on the horizontal axis, produces an inverted U-shape curve[6].

The seminal work relating environmental protection to income is by Grossman and Krueger (1993, 1995). They looked at the relationship between ambient air quality and per capita income in a set of between 50 and 120 developed - and developing - country cities. (Air quality data were available for different cities depending on the indicators used, hence the spread in sample size.) They regressed indicators of sulphur dioxide levels and suspended particulates against a set of independent variables including GDP per capita, city location, neighbourhood where air quality data were collected, trade intensity of the country, population density at the air sample site, and so on. They found that ambient

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4 For example, Balassa (1968, p. 195) states that "increases in nominal and effective duties from lower to higher stages of transformation point to the existence of discrimination against the processed export products of developing countries." A similar position concerning the influence of escalating tariffs has been taken by Johnson (1965). Representative studies which document the existence of tariff escalation in developed countries include UNCTAD (1968, 1980) and Safadi and Yeats (1994). Safadi and Yeats (1994) argue that a trade bias against processed commodities may occur even when there is no escalation in nominal tariffs because of generally higher import demand elasticities for processed as opposed to primary commodities.

5 In fact the World Bank reported on research that examined the relationship between dependence on primary commodities and economic growth in 87 developing countries (World Bank, 1994). The study concluded that "[] there appears to be a clear relationship between economic growth and the decline in dependence on primary exports. The higher the economic growth, the more rapidly does diversification of the production and export base take place. Perhaps more important, the faster the growth in commodities, the more rapid the diversification of the economy away from commodities and toward manufacturing."

6 However, the inverted U-shape hypothesis holds when pollution intensity is related to income per capita, but not when pollution intensity is expressed per unit of manufacturing output. Thus, for example, global carbon emissions have continued to increase with rising incomes, as increases in the capital stock have over-shadowed improvements in the capital stock. It remains to be seen at what point a cross over might occur, such that not only pollution intensity but also absolute levels decrease with rising incomes. The role of technical progress and technical diffusion is clearly crucial, but many complex factors will influence this relationship, not all of them fully understood.

quantities of sulphur dioxide increased with per capita GDP up to a level of between $4,000 and $5,000, and decreased thereafter. The level of suspended particulates decreased with per capita GDP up to a level of about $9,000, after which it remained fairly constant. Grossman and Krueger interpret these results to mean that when incomes rise to the appropriate level, people begin demanding public policies to reduce sulphur dioxide emissions.

Lucas et al (1991) looked at the relationship between GDP per capita and toxic intensity of pollution (pollution per dollar's worth of output) across some eighty countries. They apply U.S. EPA Toxic Release Inventory data to calculate pollution intensities for all countries; thus their results reflect the relationship between GDP per capita and the composition of output, rather than differences in emissions levels in different countries. They find that emissions relative to GDP grow at low levels of income up to perhaps $8,000-9,000, and then begin dropping. However emissions as a share of manufacturing output rise steadily with GDP; thus the drop in the first indicator reflects the declining share of manufacturing in income, rather than a shift in the composition of manufacturing towards less polluting activities.

Clearly, removal of tariff escalation would not by itself bring low-income countries up to this turning point. However, to the extent that removal of tariff escalation increased income, it could contribute to this path and thereby contribute to the creation of better conditions for environmental protection.

Be that as it may, a more fundamental question is one of achieving the right perspective on the actual magnitude of the issue. In other words, is tariff escalation in itself likely to be an economic factor sufficient to have any significant effect at the aggregate level? The section that follows attempts to provide an indication of what available evidence suggests as an answer to this question.

Box 1 Characteristics of SITC-Based Commodity Processing Chains

Although the approach has several recognised imperfections, a number of empirical studies have utilised the Standard International Trade Classification (SITC) system to construct "commodity processing chains" (Balassa 1968, Laird and Yeats 1987, and Safadi and Yeats (1994)). These chains trace individual commodities like cocoa and coffee beans, or cotton, jute and iron ore, through successive stages with each experiencing a greater degree of processing than the former. After detailed analysis of the SITC system, the World Bank was able to construct processing chains for 49 different commodities (see Appendix 1 for details). In 1990, the individual components of these chains accounted for approximately 85 per cent of all developing countries' exports.

The major advantage of an SITC-based processing chain framework for analysis is that it provides a common basis for merging trade and trade barrier information. That is, the processing chains allow one to tabulate a country's imports or exports of each stage in a given chain and match this information directly with statistics on tariffs and non-tariff barriers. The following example shows the three stages of the lead processing chain, a hypothetical country's 1990 imports at each stage, as well as that country's average (un-weighted) tariff on each product. Note how the import duties increase or 'escalate' as one moves from lead ore to wrought lead alloys.

Processing Stage (SITC)	***Value ($ mill.)***	***Share***	***Tariff***
LEAD			
Lead Ore (283.4)	120.3	57.1	0.0
Un-Worked Lead Alloy (685.1)	87.9	41.7	3.2
Wrought Lead Alloys (685.2)	2.5	1.2	5.8
All Stages	210.7	100.0	

Two specific points should be noted concerning these SITC-based processing chains. First, the level of detail changes from chain to chain due to the nature of the SITC system. That is, several chains like cocoa and wood pulp contain three and four stages while other commodities like coffee or copra only include an unprocessed and processed stage. Second, there is a phenomenon of "leakages" in some chains, i.e., some commodities may be production inputs for items not included in the chain's components and lost from the analysis. It is acknowledged that the existence of such “leakages” may produce distortions in SITC-based analyses of trade barrier escalation.

III. The extent of tariff escalation in OECD countries

Data sources and methodology

In this study a World Bank classification scheme was used in order to identify different levels of fabrication for 49 commodities exported in primary and processed form (see Appendix 1 for full details on the components of each stage identified in terms of SITC products). At a minimum, the scheme distinguishes between a primary and processed stage product (i.e., the primary stage of the coffee chain consists of green and roasted coffee beans (SITC 071. 1), while the processed stage consists of coffee extracts (SITC 071.2). In other instances, a semi-fabricated stage or stages are identified (i.e., the cocoa chain consists of cocoa beans (primary stage), cocoa powder and butter (intermediate stages), with chocolate being the final stage item).

The sample includes the 25 OECD Member countries as of 1994. Statistics on the sample countries' imports of each processing chain's stages were drawn from the United Nations COMTRADE data base. In a few cases, trade data for individual commodity processing chains were aggregated into broad product groups (e. g., food and feeds; agricultural materials; ores and minerals and energy products) to focus on broad trends in primary and processed products' import shares. Statistics on the OECD countries' tariffs were compiled directly from WTO, World Bank and UNCTAD documents. Since the tariff data were recorded at the tariff line level, available concordances were used to aggregate these data to Standard International Trade Classification (SITC) groups. This procedure allowed the UN trade data to be matched directly with countries' tariff information.

The commodity structure of trade

Two key aspects should be considered in an assessment of escalation issues: (1) the structure of imports of the countries in question in relation to primary and processed products; and (2) the structure of the countries’ tariffs, i.e., whether or not these countries' tariffs (and other trade barriers) escalate.

Table 1 presents summary information on OECD countries’ commodity imports from LDCs in 1994 (the latest year for which comprehensive trade data are available).[7] The reported data are aggregates of all 49 individual commodity processing chains (see Appendix 1) that have been classified under four broad headings (food and feeds, agricultural materials, ores and metals, and energy products). The first five columns of the table show each country's imports of all primary and processed stages of the chains while the next five show the share of primary (unprocessed) stage products in total imports. Finally, the individual country results are aggregated into an overall total for OECD imports from LDCs, and for OECD imports from all sources as well as those of LDCs from all sources in order to obtain world total (see memo items).

[7] "Leakages" may occur as one goes up the processing chains since some products may be employed as inputs for production processes which are not a formal part of the chain. For example, cotton fiber may be used for the manufacture of rubber tires and not appear in the textile stages of the cotton chain. Such "leakages" may cause the magnitude of the shift to processed commodity imports to be understated and may also affect the accuracy of estimates of the escalation in tariffs and non-tariff barriers. If trade barriers are lower for products where leakages occur than for goods included in the formal definition of the processing chain, the extent and magnitude of escalation will be overstated.

Overall, Table 1 shows that approximately 63 per cent (by value) of OECD commodity imports from LDCs are composed of primary (unprocessed) stage commodities. The share of primary stage products in OECD imports of total non-energy commodities was 54 per cent in 1994.[8]

Table 1 reveals considerable variation in individual country results. Turkey records the highest overall degree of primary commodity import concentration (74 per cent of Turkey's commodity imports from LDC's are primary stage items). Japan follows with a 69 per cent share, while the share of the fifteen European Union countries is 67 per cent. At 32 per cent, Mexico reports the lowest concentration of primary commodity imports followed by Iceland (33 per cent). Excluding energy products, Japan records the highest share of primary stage products in total commodity imports (67 per cent), followed by Turkey (60 per cent), Norway and Switzerland each with a 57 per cent share. Australia records the lowest share (28 per cent).

In terms of individual commodities, twenty primary products contributed up to 97 per cent of OECD's imports of such commodities from LDCs in 1994 (Table 2). At 40 per cent, petroleum's share was the highest, followed by fruits (9 per cent), shellfish (8 per cent), coffee (8 per cent), fish (5 per cent), iron (3 per cent), vegetables (3 per cent), rubber (3 per cent), wood (3 per cent), cocoa (3 per cent), copper and soya beans each with a 2 per cent share in imports of OECD countries of primary commodities from LDCs. Invariably, the US, EU(15) and Japan represented the major markets for these goods: they were the destination for some 94 per cent of all energy primary products originating from LDCs, fruits (91 per cent), shellfish (97 per cent), and coffee (92 per cent).

In respect of processed commodities, twenty such products accounted for 96 per cent of total OECD countries' imports of processed commodities from LDCs. Leather goods made up 27 per cent, followed by petroleum (13 per cent), wood (10 per cent), cotton (7 per cent) and fruits (6 per cent). Once again, the three major OECD markets (the US, EU(15) and Japan) had the lion's share of such imports (92 per cent of the total).

An important related point is how this structure is evolving over time. Table 3 addresses this point by tabulating the value of OECD imports of primary and processed commodities from LDCs during the period 1980-94 (Appendix Table 2 provides detailed country data).

Between 1980 and 1994, the rate of growth of OECD imports of non-energy primary products from LDCs increased by 3 per cent; that of non-energy processed commodities increased by 9 per cent, three times faster. Thus, between 1980 and 1994 the share of OECD imports of unprocessed commodities from LDCs declined by approximately 19 percentage points (from 73 to 54 per cent, Graph 1).

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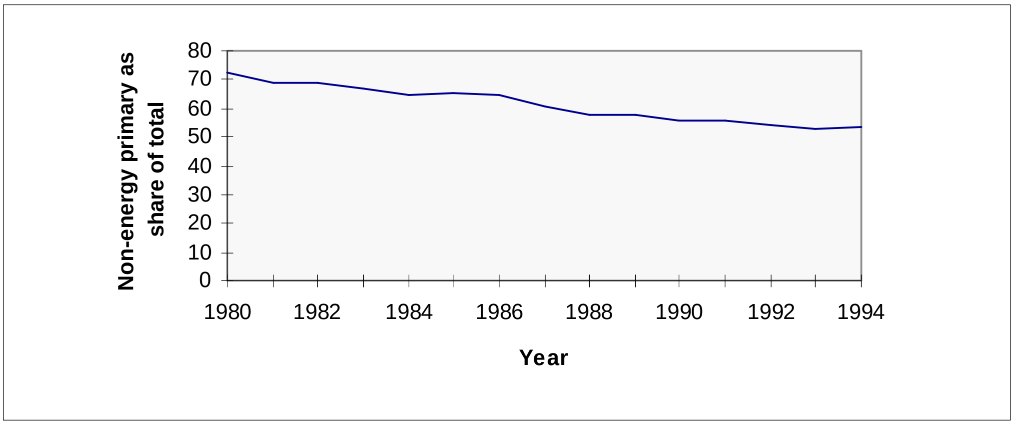
[8] Of course, these overall averages will reflect a country's natural resource endowments. If, for example, a country has abundant natural resources it would tend to have relatively lower processed good imports, ceteris paribus, than countries not so well endowed if resource availability stimulates domestic processing. International transport costs could work toward this end since many bulky low value primary commodities often have relatively high nominal freight costs which may decline significantly with further processing, although this is not always the case. For some commodities like metal ores, storage factors decline sharply with processing which makes the fabricated product easier to transport. For these reasons there may be a tendency for a processing activity to be located close to available supplies of some natural resources. Of course, escalating trade barriers in major international markets would be an offsetting factor. There are some products, however, like wood manufactures that become more fragile or subject to pilferage after processing than the primary commodity input (wood). For such items, transport costs may have an insignificant effect on the location of processing activity.

Graph 1. Trend in the relative importance of OECD countries' imports of non-energy primary commodities from LDCs, 1980-1994.



In terms of the global pattern of trade in primary commodities, such trade has grown much more slowly than world GDP and has accounted for a declining share in world trade. However, this trend does not diminish the considerable importance of commodity exports to many LDCs. In 1993, twenty-nine out of forty-nine Sub-Saharan African countries and eighteen of thirty-eight Latin American countries depended on primary commodities for more than 50 per cent of their export earnings (World Bank, 1994). The major markets for most of these commodity producers are OECD countries where seventy-two per cent of the world's commodity exports find their way, more or less in proportion to OECD countries' share in world GDP and world imports of manufactures.

It is also worth noting that about half of the world's exports of primary commodities are accounted for by OECD countries, and this proportion has remained more or less the same over several decades. OECD countries dominate timber exports, where their share of total was 62 per cent in 1993, vegetables (67 per cent), energy exports (73 per cent), tubers (75 per cent), cereals (80 per cent), and dairy products (89 per cent). LDCs dominate world markets in tobacco (60 per cent), sugar (65 per cent), coffee, cocoa (80 per cent), tea (80 per cent), and rubber (90 per cent).

However, as was stated earlier, in both OECD countries and LDCs, primary commodities have contributed a smaller and smaller share of total exports. In OECD countries, this share has halved from 17 per cent to 9 per cent over three decades (1960-1990); for all LDCs, the share has also halved from 75 per cent to 38 per cent. This decline reflects the slower growth of world trade in commodities and the correspondingly higher growth in manufactures and services (World Bank, 1994).

The World Bank reported on research that investigated the factors that have led primary commodity trade to make up a smaller and smaller share of world trade (World Bank, 1994). The study identified two main causes: (1) low income elasticity of demand (mainly for food); and (2) declining intensity of raw materials use in economic activity.

Empirical evidence shows an inverse relationship between consumption of primary commodities (mainly food) and incomes. Thus, in the US, less than 10 per cent of total personal expenditures were spent on food in 1989-90. For Canada, Japan, France, Australia, Italy, Hong Kong and Singapore, the share was between 10 and 20 per cent. In India, food expenditures account for about 50 per cent of total personal expenditures; in Mexico, where per capita incomes are significantly higher than in India, the share is closer to 37 per cent. This suggests that the growth in demand for food will inevitably be slower than the growth in incomes (Mitchell and Ingco, 1993). In terms of raw materials consumption, the World Bank study has identified the following factors which work to restrain the growth of primary commodities below that in incomes: the evolution in the structure of economic activity in the key consuming countries towards products and services that require less material inputs; the development of substitutes, and a decline in the materials intensity of industrial output generally.

Other industrial organisation studies have also suggested that changes in the organisational structure of commodity markets may have also contributed to the declining share of primary commodities in total trade. The high costs associated with processing, packaging, advertising, marketing and distribution means that the cost of primary commodities as a share of the processed product price is usually small. For example, for raw cotton, the growers' price represents about 4-8 per cent of the final product price; for tobacco, this share is closer to 6 per cent. For bananas, producer countries obtain about 14 per cent of the retail price; for jute goods, it is 11-24 per cent; for coffee, it is in the range of 12 to 25 per cent (World Bank, 1994).

Some studies show the final consumer markets for some commodities are dominated by few TNCs who control downstream marketing, transport and distribution (Scherer 1984 provides an excellent survey of these studies). Thus, a few TNCs account for 85 per cent or more of world trade in wheat, coffee, cocoa, grains, iron ore, jute, timber, tobacco and tea (Table 4).[9] To the extent that the concentration of market power has led some TNCs to exert monopsony pressure on suppliers of primary commodities, this could partly explain the observed declining prices of primary commodities (and hence their declining share in world trade). However, studies that have investigated this link have found little evidence to establish or to refute whether high concentration of market power exerted downward pressure on primary commodities' prices.

IV. The structure of OECD tariff barriers

The analysis to this point has shown that, as a matter of fact, OECD countries import a large proportion of commodity imports in an unprocessed form (63 per cent) from LDCs, but that this proportion has declined during the last fifteen years (Table 3). It has also been indicated that there are a range of factors that can be said to have contributed to this. To what extent can tariff escalation in OECD countries be said to be a contributing factor?

Table 5-A draws on GATT tariff data for OECD countries in order to provide relevant information. The table shows the average trade-weighted (using 1990 trade flows) import duties all OECD countries apply to the primary stage product in the 49 commodity chains, as well as the corresponding trade-weighted tariffs on the final stage product for imports originating from LDCs. The table reports applied as well as bound MFN trade-weighted tariffs for two periods: those that were in force prior to the successful conclusion of the Uruguay Round of tariff negotiations, and those that were agreed as a result of the Uruguay Round. Finally, the table computes two escalation indicators that compare pre- with post Uruguay Round tariffs.

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[9] The high concentration of trade in the hands of a few large TNCs in such a wide range of commodities can be partly explained by the difficulty producer countries encounter in distributing and marketing their products independently. For some countries, the difficulties are accentuated by scale economies in processing (Braga and Silber, 1993). For others, large investments by TNCs in advertising have given them brand name recognition and loyalty, two factors which are extremely hard to overcome in the absence of equally large investments by competitors (World Bank, 1994).

Comparing tariffs against processed commodities with those that affect the primary ones, it is clear from Table 5-A that nominal tariff escalation affects the majority of the processing chains, and that is true whether one examines applied or bound MFN tariff rates. Of the 48 commodities for which data were available (it was not possible to find comprehensive tariff data on tea), rice, soya beans and vegetables were the only commodities whose stages of production did not involve escalating tariffs (be that in reference to applied or bound MFN tariff rates). Of the remaining 45 commodity chains, asbestos and feathers processing chains did not include escalating MFN tariffs in the pre-Uruguay Round trading environment.

However, how significant is the extent of that escalation? Analysis of Table 5 suggests that most post-Uruguay Round tariffs do not appear to constitute a major constraint against the further processing and exports of LDC commodities in the aggregate. A key point that emerges from Table 5-A is that only 5 commodity processing chains display applied tariff rates of 10 per cent or more for the post-Uruguay Round duty. The highest incidence of applied tariffs affected tobacco products where the pre-Uruguay Round applied rate was 57 per cent, followed by sulphur and manganese (17 per cent), fruits (14 per cent) and cocoa (13 per cent). The same products also emerged as the only ones which, following the conclusion of the Uruguay Round, remain affected by applied tariffs that are higher than 10 per cent.[10] For 31 categories, the post-Uruguay Round applied rate is less than 5 per cent.

It is worth noting that previous analyses of tariff escalation have focused almost exclusively on the structure of bound MFN tariff rates. Table 5 clearly shows that such a focus may not be the correct one. Import duties declined significantly once account has been taken of the preferences LDCs receive in OECD markets through GSP, CBI, Lome Convention or other preference schemes.[11]

It is also worth noting that many of the studies that are currently being cited as evidence of the extent of tariff escalation use pre-Kennedy Round tariffs which averaged about 15 per cent on OECD imports of processed commodities originating in LDCs. Tariffs have been substantially reduced by the Kennedy, Tokyo and Uruguay Rounds, and their trade distorting effects have been greatly reduced.

Table 5-A also examines the effect of the Uruguay Round on the practice of tariff escalation using two approaches both of which examine the change between processed and primary commodities only: the first approach indicates the effect on the absolute change in tariffs, while the second calculates the change in the relative position of tariffs.

Focusing on the results related to the Uruguay Round achievements in applied rates, a product-by-product examination of the absolute difference between tariffs on the first and last stages of processing reveals that of a total of 43 commodity processing chains that were subject to tariff escalation pre-Uruguay

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[10] The picture looks different if one examines only bound MFN rates. Pre-Uruguay Round MFN rates greater than 10 per cent affected a total of 17 commodity processing chains (again the final stage of tobacco processing carried the highest MFN tariff rate of 82 per cent). The conclusion of the Uruguay Round brought the final count down to 9 commodity chains with bound MFN tariffs that are higher than 10 per cent.

[11] Preferences do not just improve the ability of a country to compete internationally, but in addition it enhances its chances of becoming a location for commodity processing. A key related point in this respect (a point that is obsecured by the way the data are reported in Table 5) is the variation in the countries designated as preference beneficiaries. For example, the processing chains for groundnuts, cotton and wool involve preferences that are only extended to least developed and Lome Convention countries with the result that GSP eligible countries face higher tariffs on the processed stages of these goods. In addition, for some metal products, the coverage of intermediate stage processing is even more limited as preferences are extended only to Lome Convention countries.

Round, the extent of tariff escalation has been reduced in 36 and increased in 7 (see Table 5-B for a list of products whose processing chains experienced an increase in tariff escalation).[12] In terms of the relative difference, the number of products that experienced an increase in the incidence of tariff escalation goes up to 21.[13]

All of this suggests that while tariff escalation may, in some cases, act as a barrier against further processing, its current relative importance should not be overestimated at the aggregate level.

There are, however, some other important elements to be taken into account.

First, it should be noted that the economic significance of tariff escalation practices may be accentuated by the fact that some seemingly low nominal tariffs on processed commodities may conceal higher rates of effective protection. Effective rates of protection focus on the value-added in an industry and indicate the extent to which returns to factors of production must be reduced if foreign suppliers are to penetrate third markets. Expressed differently, in order to be able to sell in any protected market, foreign producers have to operate with a value-added smaller than that in the importing country (see Box 2).

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[12] Recall that rice, soya beans vegetables, asbestos and feathers did not experience escalating applied tariff rates prior to the Uruguay Round. Add tea to the list and the count of the remaining commodities processing chains goes down to 43.

[13] See the notes at the end of Table 5 for the arithmetic formulas used to obtain both indicators. It must be noted that the absolute change in tariffs is more relevant for escalation analysis. In terms of stimulating exports, what matters is the decline in the tariff-inclusive price in the importing country. For example, a 50 percent cut in a 2 percent tariff will lead, in principle, to a 1 percent decline in the tariff-inclusive price. A 25 percent reduction in a 36 percent tariff would result in a 6.6 percent reduction in its tariff-inclusive price.

Box 2 The Effective Rate of Protection

The effective rate of protection is defined as the increment in value added made possible by the tariff structure as a proportion of the free trade value added. If under free trade a good which sells at $100 uses imported inputs worth $50, the domestic value added is $50. If a 10 per cent tariff is imposed on imports of this good, the nominal tariff rate is 10 per cent. If the imported inputs remain free of duty, the effective rate of tariff protection will be 20 per cent since the good produced domestically can now sell at $110, which represents an increment of $10 on free trade value added of $50. The effective rate exceeds the nominal rate because the 10 per cent effectively applies to only half the inputs into the good, namely those which are supplied domestically. It is possible for the effective protection rate to be negative, if the imported inputs are subject to higher rates of duty than the final good. More generally, effective rates of tariff protection will be higher than, equal to or lower than nominal duties, depending on whether nominal duties on the final product exceed, equal or fall short of those on material inputs. The difference in effective and nominal rates of protection further depend on the share of value added in output.

Assuming that inputs coefficients are constant in the relevant range and the domestic prices of all traded commodities equal the world market price plus the tariff, the effective rate of tariff protection on good i (ERPi) can be expressed by the use of the following formula:

$$ERP_i = \frac{T_i - \sum_{i=1}^{n} a_i t_i}{1 - \sum_{i=1}^{n} a_i}$$

where T_i is the tariff on the final good, t_i are the tariffs on inputs whose shares in production are a_i. In the example above, T_i = 10 per cent; a_i = 50 per cent and $t_i = 0$, thus

ERP_i = (.1 -0.5*0)/(1 - 0.5) = 20 per cent.

Second, while Table 5 indicates that the extent of tariff escalation may not be as pronounced as once thought, other trade barriers may also be an important factor, not captured by the tariff data alone. Several OECD countries employ non-tariff barriers, like quotas, licensing requirements, or other charges on imports. It is also worth noting that the actual economic effects of nominal trade barriers are affected by import demand elasticities for the goods in question (see Box 3).

Box 3 Can a Trade Bias Against Processed Goods Still Occur if there is no nominal Escalation of Trade Barriers?

Analysis of trade barrier escalation needs to distinguish between two points: formal trade barrier escalation which refers to tariffs and NTBs rising with fabrication, and the influence of these barriers on the structure of trade. To account properly for the latter, one must analyse changing conditions of demand at different levels of processing. Since empirical studies show import demand elasticities normally increase with fabrication, constant tariffs will have relatively larger trade effects on fabricated commodities than on unprocessed commodities.

This point can be clarified with the following example. Assume that the leather processing chain is composed of three distinct stages (hides, leather and leather manufactures), and import demand elasticities range from 0.6 for hides to over 2.0 for leather manufactures in OECD countries. For illustration, it is assumed that the importing country applies a constant 10 per cent tariff and imports $20 million in each processing stage. There is no tariff escalation, yet the tariff has more of a retarding effect on leather manufactures due to the more 'sensitive' demand for these products. Specifically, reducing the tariff for hides to 5 per cent would increase imports by $558,000. A similar cut applied to leather manufactures would increase imports by more than three times this amount. Thus, in assessing the influence of trade barriers, consideration should be given to underlying demand conditions to draw meaningful conclusions about their influence on the trade structure.

Processing Stage	*Nominal Tariffs*	*Imports ($ Mil.)*	*Import demand elasticity*	*Projected change with a per cent tariff cut*
Hides & skins	10	20	-0.62	558
leather	10	20	-1.28	1152
leather mfg.	10	20	-2.11	1899

Note: the projected import change is based on a partial equilibrium trade model in which the estimated change in imports is derived from a multiplicative function involving the initial level of imports, the import demand elasticity, and the change in the landed price of the good due to the tariff reduction.

Finally, another important point to keep in mind relates to the fact that although in the aggregate nominal tariffs LDCs products face in OECD markets are low when measured on a trade-weighted basis, this conceals the presence of tariff peaks. In addition, these averages have an obvious practical limitation in view of the fact that high tariff commodities are given lower weights since, other things equal, the higher the tariffs the more imports are restricted.

V. Tariff escalation in developing countries

Table 6 draws on World Bank and UNCTAD tariff data for four LDCs. The table shows the average pre-Uruguay Round applied import duty each country applied to the primary stage item in 45 commodity chains for which comprehensive data were available, as well as the tariff on the final stage. Tariff averages have been computed for all 45 commodity chains and their differences are used as an overall measure for each market. It is clear from Table 5 that tariff escalation occurred in the majority of the processing chains. In Indonesia, 81 per cent of the processed commodities had higher average applied tariffs than do the primary stage components, and in several cases the spread in duties over a chain exceeded 40 percentage points (e.g., silk and cotton). Overall, the average difference in tariffs on primary and processed commodities was as high as 19 per cent in the case of Thailand, 16 per cent in the cases of Indonesia and the Philippines, and 9 per cent in the case of Malaysia.

VI. Empirical evidence on sectoral environmental impacts

The previous section suggests that the relative importance of tariff escalation as a determinant of shifts in location from raw material production vis-à-vis processing should not be over-estimated overall. Nevertheless it may still be useful to examine, more generally, some available literature on how downstream linkages might operate when it comes to relative environmental effects of processing vis-à-vis raw material production.

At the general level it might be observed that a potential effect of the redistribution of processing activities among countries argued to result from tariff escalation practices, is that it contributes to a non-optimal rate of depletion of scarce natural resources and increased environmental degradation; in other words, it contributes to a type of development that is not sustainable. The argument goes as follows: tariff escalation practices stimulate downstream processing activities in the importing country at the expense of third countries. In case the third countries happen to have a comparative advantage in unprocessed or semi-processed primary products which are more intensive in their use of environmental resources, then tariff escalation practices may put pressure on third countries to expand output of these products in order to maintain foreign exchange earnings, potentially adding damage to the environment.[14] Put differently, the elimination of tariff escalation practices in importing countries would stimulate the demand for processed commodities, and would thus induce producers of primary commodities to shift their production away from primary commodities and more into processed ones. To the extent that the value-added originating from processing activities is higher than that from primary production, the pressure on third countries to expand primary commodity output (in order to meet foreign exchange earnings) will be relaxed. In addition, by depressing the value of the primary product, the practice of tariff escalation encourages less careful management of the resource and provides greater incentives to find alternative uses for it that may be more environmentally damaging (see footnote 4 for an example).

At the same time, the point needs to be made that it is often simply assumed that the environmental degradation arising from producing primary products is more severe than the environmental effect of further processing, at least per dollar. So it is assumed that a reduced reliance on primary production consequent on the removal of tariff escalation, while processing activity increases, will have a direct environmental benefit. Whether this is the case or not is an empirical question that would depend on the economy, ecology and policies present in each processing chain. We review below the evidence of environmental issues in particular sectors. The most that can be said in general is that to the extent there is a decrease in raw material production, whatever environmental damage is linked to that (such as soil erosion or resource depletion) would presumably decrease while any environmental damage caused by the processing activity (such as emissions) would presumably increase.

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[14] Another issue worth noting is the extensive use of export taxes by LDCs for the same purpose: export taxes are higher if products are exported in their primary form than the processed form and hence tend to protect the processing activity in the country which produces the primary product. Though the effects of export taxes and tariff escalation may be offsetting in terms of the distribution of processing activities, both measures may be just as liable to produce adverse effects on the environment. The potential environmental effects of export taxes that discriminate against primary products (and for that matter the practice of tariff escalation itself) can be illustrated in reference to the experience of Indonesia where trade policy instruments were used as a mechanism for resource management in the forestry sector. In Indonesia, the discrimination in favour of local wood processors resulting from higher export taxes on primary products led to a more intensive use of logs in production as a result of the relative inefficiency of the local industry. Thus, contrary to the perception of some, the use of export restrictions at the primary level visited additional environmental degradation upon the wet tropical forests of Indonesia than e.g. a resource management programme involving a tax on all timber at the logging stage would have done. An import embargo on a raw material can offer another example. An import ban can well depress the price of the product, thereby assigning lower value to the resource, and encouraging less careful management of it.

Further, it is often assumed that removal of tariff escalation would result in a reduction of commodity production. However, to the extent the price of the final product falls, there will be an increased demand for it and therefore also for the raw material inputs. Thus there may be a net increase in t he total amount of commodity produced. Even for the same quantity of final product, if the processing is shifted from the final importer to the commodity-producer, it is possible that the processing will be technically less efficient and hence require more raw material inputs per unit of final product.

Be that as it may, as an empirical matter, a number of factors should be examined in particular cases.

First, primary production may affect the long-term sustainability of the resource base, through deforestation, soil erosion, habitat destruction, depletion of biodiversity, and so on. Quantifying such impacts can be very difficult, for lack of data and clear methods for using them. Commodity production may also lead to water pollution from agrochemical runoff. This is very difficult to measure as a practical matter.

Processing activities, in contrast, may be more likely to result in land, water and air pollution rather than in destruction of the resource base. These point-source impacts can be quantified more easily, but it is not clear how to compare them with natural resource sustainability.

Second, location can affect the environmental impact of each stage in processing a specific commodity. Several factors might cause impacts to vary based on location:

- The ambient environment; the same level of harvesting or pollution will have different impacts depending on the absorptive capacity of the environment. For example, air pollutants discharged in an environment where there is relatively little industry and prevailing ocean winds disperse pollution rapidly, will be less harmful than pollutants discharged in a highly industrialised city where temperature inversions keep air from moving in the summer.

- Differences in relative prices which lead to different technology mixes in production. For example, cotton grown where labour is cheap and imported agrochemicals expensive, is likely to generate less chemical pollution than cotton grown where the reverse is true.

- The environmental policy context. Production of a given level of output (at any stage of the chain) will be carried out differently, with differing environmental impact, depending on the country's environmental protection requirements. Thus tanneries in Europe will guarantee that toxic chemicals are not discharged into adjacent water bodies, whereas tanneries in North Africa may contaminate drinking water supply because such pollution is not prohibited, or prohibitions in place cannot be enforced.

- The availability of up-to-date pollution control technology. The markets for such technology may be more accessible in wealthier countries, making the environmental impacts of processing worse in the developing world than in the developed world.

Fully investigating the environmental impacts of commodity production and processing would be tantamount to reviewing the vast literature on the environmental impacts of economic activity and of environmental policy. Moreover, while systematic data are available on industrial pollution in developed countries, such data are not often available for developing countries, nor are comprehensive data on natural resource degradation due to primary production available anywhere in the world. We will, therefore, take a different approach using a small set of sectoral studies and some methodological work.

Commodity Case Studies

A series of UNCTAD case studies on the environmental impacts of commodities production and processing underline that the actual effects of tariff escalation depend on a number of variables. While these cases are not focused on trade barriers, they highlight the importance of analyzing tariff changes in light of the broader economic, policy, and ecological context of the producing country. The studies consider bauxite in Indonesia (UNCTAD 1994), rice in Thailand and the Philippines (Witte et al 1993), coffee in Costa Rica and El Salvador (Segura and Reynolds 1993), cocoa in Nigeria (Akande 1993), cocoa and coffee in Cameroon (CIBLE 1993), cocoa and coffee in Brazil (May et al 1993), cocoa, coffee, and rice in Côte d'Ivoire (Seudieu 1993), and rubber (Goldthorpe 1993); in addition there is a synthesis by the UNCTAD secretariat (UNCTAD 1993).

Each study reviews the environmental impacts of raw materials production and processing, the importance of the commodity to the economy, the impact of the national environmental policy on the commodity, and trends in world markets for the commodity. (The rubber study does not focus on a specific country, so it addresses only environmental effects.)

Arguments for reducing tariff escalation are often based on an assumption that primary production is worse for the environment than processing, and decreases in primary production would be beneficial. While this may be so in some cases, the cases highlight that it is not necessarily so. Agricultural products such as rubber and cocoa can be of net benefit to the environment, because they provide ecological services such as erosion control, wildlife habitat, carbon fixation, and improvements in soil quality (Goldthorpe 1993, May et al 1993). Whether a given crop is beneficial in a particular location depends on the alternative; where the forest is destroyed to plant crops, cultivation may be considered harmful, but frequently the alternative is other crops that are much harder on soil and water resources. Even if we could predict a decrease in primary output due to the elimination of tariff escalation, this would not always allow us *a priori* to predict benefit to the environment; nor would an increase in primary output allow us to predict an *a priori* benefit.

Even for a given commodity, the net environmental impact of primary production can vary across countries depending on the ambient environment, production technology, and alternate uses of the land. A comparison of the impacts of coffee-growing in Costa Rica, El Salvador and Brazil suggests how complex the situation can be. In Costa Rica (Segura and Reynolds 1993), some coffee is grown by small farmers using traditional practices, while other coffee is grown on large plantations. The traditional method is to grow coffee along with other trees which provide shade, soil conservation and enrichment, wildlife habitat, etc. The resulting agroecosystem is fairly close to natural forest in terms of the environmental services which it provides. The plantations, while offering higher yields, do not rely on shade trees, require extensive use of agrochemicals, and offer fewer environmental services. Expanded output is likely to come from destruction of natural forest to permit growth in the plantation sector, and therefore to be relatively harmful to the environment.

In El Salvador (Segura and Reynolds 1993), almost all the natural forest is already gone and all coffee is grown in plantations. El Salvadoran coffee plantations do use shade trees, unlike the Costa Rican ones. The coffee plantations are in effect the only forest remaining in the country to provide ecosystem services. An expansion of coffee production would therefore be of net benefit to the environment, by increasing the forested area.

Finally, the pattern in Brazil is quite different (May et al 1993). Historically, Brazilian coffee growing has followed a pattern of long-term migration as the soil became too eroded to provide satisfactory needs. Once eroded, the land is only suitable for grazing; however the time period involved is long enough for it to be an intergenerational problem whose cost is too distant to motivate more sustainable practices. Expanded production may therefore be harmful to the environment. The differences between Brazil, El Salvador, and Costa Rica highlight the need to understand local production systems in order to predict the impact of tariff changes on the environment.

All of the cases address certain direct impacts of commodity production and processing; water pollution, land degradation, air pollution, worker health. Some studies also raise the possibility of other environmental impacts, through energy use, leaching from discarded by-products, greenhouse gas production, carbon fixation, environmental impacts of substitutes for the commodity under study, and so on. It is difficult to compare and draw conclusions from the cases, which do not all consider the same impacts.

A perhaps more important corollary of the need to specify the environmental impacts of interest is the need to find ways of comparing them. If we are concerned with the relative environmental impacts of production and processing, we need to be able to compare them; water pollution with loss of forest habitat, sedimentation of waterways with air pollution, and so on. Some of the UNCTAD cases prioritise the different forms of environmental harm they describe. For example, the study of rice in Thailand and the Philippines (Witte et al 1993) ranks the environmental effects described in the following order of decreasing importance: pesticides use and pollution, water supply, biodiversity loss, use of non-renewable energy, depletion of mineral resources, soil toxicity, methane emissions. While this a start, it is not sufficient to permit reliable comparison of impacts, comparison of commodities, or international comparisons.

The cases highlight the importance of fluctuations in world markets in determining levels of output and the environmental impacts of production. It also places the issue of tariff escalation in some perspective. In the cases of rice and coffee, in particular, sharp drops in world prices led to changes in both production technology and output, with marked impacts on the environment (Witte et al 1993, Segura and Reynolds 1993, May et al 1993). These price changes far exceeded those which we might anticipate from the removal of escalating tariffs, at least based on nominal tariffs and estimates of effective protection (UNCTAD 1994). In the face of such massive and recent price uncertainty, producers may not respond strongly to much smaller changes which would result from the removal of tariff escalation.

The cases consider, in varying levels of detail, the impact of domestic environmental policy on the impacts of production and processing. The impact of any output growth will depend in part on whether the country has environmental controls in place and whether they are effectively enforced. The countries studied have ineffective environmental policy to deal with agriculture-related concerns such as clearcutting for cultivation, the use of agroforestry techniques to prevent soil erosion and minimize need for chemical inputs, or pesticide use (beyond bans of some chemicals, not necessarily enforced). On processing, environmental protection is more effective in some countries; for example, in Brazil secondary coffee processors (roasting and manufacture of instant coffee) must meet fairly stringent pollution controls (May et al 1993). In contrast, primary processing of both coffee and cocoa (hulling, cleaning and drying the beans), which is more often carried out by small-scale farmers, leads to unregulated wastes both on land and on water.

This raises the difference between the "traditional" and "modern" sectors with regard to the ability of government to regulate the environmental impact of their activities and their ability to absorb the costs of environmental protection. These factors, in influencing the potential effectiveness of environmental policy, will also affect the environmental impact of any increases in output generated by changes in tariff policy.

A somewhat related issue concerns the country's access to pollution control technology. Two of the cases discuss this issue explicitly. In Indonesia, the major processing plant was purchased in Japan, complete with Japanese pollution control technology which exceeded anything required by Indonesian authorities (UNCTAD 1994). In Brazil, where processors were held to stringent pollution control requirements, a domestic pollution control equipment industry had developed, and was in fact exporting to the European Community (May et al 1993). This is consistent with the suggestion sometimes made (for example, in Birdsall and Wheeler 1992) that trade liberalization will improve environmental conditions because it will facilitate importing of less polluting technology.

Transportation and the environment

One of the arguments for why tariff escalation harms the environment concerns the environmental harm caused by transporting goods. The argument assumes that the elimination of tariff escalation would cause primary producers to begin processing their own goods. Then instead of shipping bulky raw materials they would ship less bulky processed goods. This would call for fewer transport-kilometers per unit of final output, with less environmental harm caused by that transportation (French 1993, WTO 1995).

Golub and Finger (1979) provided some results on the location impacts of the removal of escalating tariffs, but not enough to predict transportation effects. They found that removing all escalating taxes would increase LDC primary production by 4%, increase processing activities by 8.4%, increase export revenue by $1.2 billion, and decrease final consumption of the goods in question by 3.8%. Without knowing the initial value of primary production and processing, or the share of each in export revenue, however, we cannot determine whether these changes mean more or less raw material exports. Since Golub and Finger's work compares escalating tariffs with no tariffs, the price effects of the tariff change increase total output, and therefore could increase primary exports at the same time that they increase the LDC share of processed goods. Therefore we cannot predict the effect on shipping of these changes. In addition, they analyze changes in the value rather than the volume of LDC exports, so even if we knew the share of each good in exports we would not know the impact on quantities transported. In any case, the changes in tariff levels alone since 1979 mean the results are not applicable to current production and trade patterns.

Mode choices will have major impacts on the environmental effects of increased transportation demand. Land transport, in particular road transport, elicits greater concern than other modes because it more directly affects adjacent populations. Shipping is considered the least threatening. The extensive literature on impacts of transportation on the environment is beyond the scope of this review.

Approaches to identifying environmental Impact: life cycle assessment

The commodity case studies provide information about the impacts of primary production, processing, and exporters' trade policies. However, we are still left with the difficulty of making rigorous environmental assessments of different compositions of economic activity. The approach used in life-cycle assessment may suggest a useful way to organize the analysis of environmental impacts of productive activity. In general, life cycle analyses attempt to cover all the impacts of a decision throughout its "life", in order to base choices on complete information. The approach is widely used to analyze the cost of alternate engineering or manufacturing design options; see, for example, Ahmed (1995), Veshosky and Beidleman (1995), or Farless (1994). The energy crises of the 1970s spurred the application of life cycle analysis to the energy consumption implications of alternate choices (Curran 1992). More recently, such analyses also address the greenhouse gas emissions which result from engineering or transportation choices; for example, IEA/OECD (1993) and Morris (1992).

Use of life cycle analysis (LCA) for environmental impact assessment has focused very much on industrial production and pollutant emissions. A seminal workshop which began the work of defining a methodology for environmental LCA (Fava 1990, cited in Curran 1993) defined three components of an LCA:

An inventory of all the inputs going into a production process and products coming out (both useful and polluting);

An evaluation of the impact of those inputs and outputs on the environment; and

Changes in the manufacturing and distribution system to lessen the environmental impact.

LCA differs from traditional environmental impact analysis in its attempt to capture comprehensively a product's impact from the production of its inputs to its final disposal. It is raised here to point to the complexity involved in any rigorous attempt to assess environmental impacts from different patterns of economic activity. The data requirements for doing thorough life cycle analysis are very heavy, and good quality information is often simply not available.

The fundamental problem of how to compare different environmental impacts remains. This will be particularly important when the environmental harm takes the form of soil degradation or erosion, which is harder to quantify even in physical terms than pollution emissions. Descriptions of LCA acknowledge this problem but do not try to resolve it (Curran 1993, Keoleian 1994, Lübkert and Virtanen 1991a). Lübkert and Virtanen (1991b) suggest that the techniques of comparative risk assessment could be used to compare the environmental impacts of different production techniques. Contingent valuation could also be used for this purpose. Clearly both of these approaches are highly subjective; they may not be preferable to the impressionistic ranking of environmental impacts which we find in some of the commodity case studies.

VII. Conclusion

The above analysis does not suggest by any means that escalating trade barriers in the post-Uruguay period are the only or even a major factor that may constrain local processing in LDCs. One needs to take account of a great many factors.

For instance, there may be possible entry barriers against processed commodities as a result of high concentration of market power. Some commodities like aluminium have characteristics that favour their processing near abundant sources of energy, while others like some wood manufacturing (furniture) that increase in volume or become more difficult to transport tend to be processed near centres of consumption. Some commodity processing operations (such as petroleum refining, ferrous metals, and tobacco manufacturing) require highly capital-intensive operations that may be less suited to commodity-producing economies. Some other commodities, like refined vegetable oils require a high degree of precision and quality control in processing, something which may not be present in many LDCs. In some cases, international transport costs have been found to escalate with processing.[15] In other cases, declining

[15] "Escalating" transport costs have an impact similar to tariffs as they impose additional charges foreign producers must bear. Studies of individual liner conference pricing practices show that freight rates are set in a manner that discriminates against processed commodities. For example, a study by Yeats (1985) concluded: "The principle of charging according to the value of

productivity (particularly in Sub-Saharan Africa) and inappropriate government policies imposed major supply constraints on domestic producers that severely limited their ability to take advantage of export opportunities (Akiyama and Larson, 1993). In some situations (such as those involving Brazil's hides and skins exports or Indonesia's wood exports), export taxes or quotas were placed on the primary stage commodity in an attempt to stimulate further processing. It should also be acknowledged that some countries' comparative advantage may be in exporting unprocessed commodities and not in processing these commodities.

The analysis has also shown that the extent of tariff escalation may not be as pronounced as once thought, and this may be due, *inter alia*, to recent unilateral trade liberalisation and the Uruguay Round outcome and to various preference schemes that OECD countries extend. The evidence indicates that 31 product categories will have applied rates of less than 5 per cent with only 5 at or above 10 per cent.

These orders of magnitude regarding the relative significance of tariff escalation together with the other relevant factors to be taken into account, suggest it is difficult to conclude that tariff escalation is of major significance overall in the environmental context. That does not mean that it may not be of more economic significance in certain sectors. Where peaks exist it may well remain so. Moreover, given that the tariff data do not take into account the extent of non-tariff measures, which affect some sectors more than others, it will certainly understate the situation in those sectors.

To the extent that removal of tariff escalation increased income it could contribute to the creation of better conditions for environmental protection, bearing in mind studies showing a positive relationship between higher growth and greater demands for environmental quality. At the same time, the picture with regard to the more direct environmental impacts of primary production and processing is also complex. Effects can be location-specific: environmental impacts are determined by a wide range of factors in the natural, economic, social, and policy context. Thus, in order to reliably judge whether an increase in raw product or processed output could be considered environmentally beneficial or harmful, it is necessary to know what the alternatives would be, what production system or technology is used, what environmental protection controls are in place, and other local factors.

service that is applied by liner conferences implies that high value commodities subsidise low value commodities. Our results support this hypothesis. Excess freight factors escalate in a manner similar to tariffs. In comparison to a marginal cost-based system of charges, shipping rates tend to encourage trade in raw materials and intermediate goods and to discourage trade in processed commodities".

ANNEX 1

Table 1: The relative importance of OECD countries' imports of primary and processed commodities from LDCs in 1994 (US$ Billions).

	Value of all primary stage & processed commodities (Billion $)					Share of primary stage products in total commodities (%)				
Imports from LDCs	Food & Feeds	Agric. Matls.	Ores. & Metals	Energy Products	Total	Food & Feeds	Agric. Matls.	Ores & Metals	Energy Products	Total (a)
Australia	0.62	0.98	0.19	0.76	2.55	61	6	37	100	50 (28)
Canada	1.52	1.09	0.30	1.10	4.02	72	12	70	84	59 (49)
Iceland	0.01	0.01	0.00	0.00	0.02	73	0	0	0	39 (37)
Japan	16.07	8.56	5.26	11.86	41.75	75	37	72	82	69 (64)
Mexico	0.40	0.51	0.23	0.20	1.33	62	22	35	0	32 (39)
New Zealand	0.15	0.17	0.06	0.13	0.51	60	6	33	100	51 (32)
Norway	0.31	0.26	0.15	0.02	0.73	81	8	87	50	56 (57)
Switzerland	0.67	0.30	0.02	0.20	1.18	75	17	5	98	63 (57)
Turkey	0.21	0.43	0.15	0.80	1.56	52	65	45	90	74 (60)
USA	13.04	15.98	2.15	19.97	51.14	76	8	38	77	53 (39)
EU15	30.65	18.06	6.50	18.57	73.76	80	21	63	91	67 (59)
Total above	63.64	46.35	15.01	53.61	178.55	77	19	62	83	63 (54)
Memo items										
OECD imports from all sources	159.43	152.15	70.79	170.04	552.44	69	17	25	80	52 (40)
LDCs imports from all sources	42.23	55.04	28.69	59.20	185.16	68	31	22	67	49 (41)
World imports	201.66	207.19	99.48	229.24	737.60	69	21	24	76	52 (41)

(a) Excluding all energy products.
See Appendix 1 for the primary and processed stage products classified in each group.
Source: Appendix Table 3.

Table 2: The share of the 20 largest OECD imports of primary and processed commodities from LDCs in 1994 (in percent).

		Of Which			
Primary commodities	OECD	USA	EU15	Japan	Others
Petroleum	40	34	38	22	6
Fruit	9	24	59	8	9
Shellfish	8	28	21	48	3
Coffee	8	22	60	10	8
Fish	5	17	25	56	2
Iron	3	6	51	42	2
Vegetables	3	8	61	28	3
Rubber	3	34	34	21	10
Wood	3	0	33	64	3
Cocoa	3	17	77	2	4
Copper	2	3	28	65	4
Soya beans	2	0	80	15	5
Tobacco	2	23	59	10	7
Sugar	2	33	50	14	4
Tea	1	14	63	15	8
Cotton	1	0	73	11	15
Bauxite	1	48	40	3	9
Rice	1	2	19	79	0
Wool	1	2	71	23	4
Phosphate	0	6	56	10	28
Total above	97	25	43	26	6
All other commodities	3	6	62	23	10

		Of Which			
Processed commodities	OECD	USA	EU15	Japan	Others
Leather	27	50	35	8	7
Petroleum	13	53	18	23	5
Wood	10	24	35	36	5
Cotton	7	30	43	17	11
Fruit	6	22	51	18	8
Bauxite	5	14	43	37	6
Rubber	5	42	39	5	14
Fish	5	14	39	41	6
Iron	3	27	25	39	8
Paper	3	27	50	8	14
Vegetables	2	20	38	35	7
Shellfish	2	23	22	45	10
Poultry	1	27	52	18	2
Glass	1	29	48	10	13
Rice	1	17	18	51	14
Manganese	1	18	34	41	7
Copra	1	37	54	4	6
Silk	1	21	40	33	7
Phosphate	1	2	81	4	12
Cork	1	16	69	4	11
Total above	96	35	36	21	8
All other commodities	4	26	44	18	12

Table 3: Trend in OECD imports of non-energy primary and processed commodities from world and LDCs, 1980-1994 (US$ Billions and per cent).

Year	OECD imports from world				OECD imports from LDCs			
	Primary (a)	Processed	Total (b)	(a/b)*100	Primary (a)	Processed	Total (b)	(a/b)*100
1980	107.1	100.8	207.9	52	52.4	19.8	72.2	73
1981	97.0	93.9	190.9	51	44.9	20.0	65.0	69
1982	90.4	88.9	179.4	50	42.1	18.8	60.9	69
1983	86.8	89.3	176.0	49	41.3	20.3	61.6	67
1984	93.2	101.9	195.1	48	45.7	25.2	71.0	64
1985	92.7	104.2	196.9	47	45.7	24.4	70.2	65
1986	105.3	125.1	230.4	46	51.0	27.5	78.6	65
1987	117.0	152.2	269.2	43	52.8	34.9	87.7	60
1988	131.1	175.2	306.4	43	57.8	42.2	100.0	58
1989	135.5	184.6	320.1	42	59.0	43.7	102.7	57
1990	143.2	209.5	352.7	41	60.7	47.8	108.6	56
1991	145.4	209.7	355.2	41	61.7	49.6	111.3	55
1992	147.5	220.0	367.5	40	60.6	50.7	111.4	54
1993	136.1	200.1	336.2	40	57.7	51.6	109.2	53
1994	154.6	227.8	382.4	40	67.3	57.7	125.0	54

Table 4: Estimated shares of commodity trade controlled by TNCs (per cent)

Commodity	Proportion of global exports marketed by 3-6 largest TNCs
Foods & beverages	
Wheat	85-90
Maize	85-90
Sugar	60
Coffee	85-90
Rice	70
Cocoa beans	85
Tea	80
Bananas	70-75
Agricultural raw materials	
Timber	90
Cotton	85-90
Hides & skins	25
Tobacco	85-90
Natural rubber	70-75
Jute & jute products	85-90
Minerals & metals	
Copper	80-85
Iron ore	90-95
Bauxite & alumina	80-85
Tin	75-80
Phosphate rock	50-60

Source: Clairmonte and Cavanaugh, 1988.

Table 5-A: Pre and Post-Uruguay Round trade-weighted average applied and MFN tariff rates on OECD countries' imports of commodities from LDCs, by stages of processing, and the effect of the Uruguay Round concessions on tariff escalation in OECD countries.

	Tariff rates				Change in escalation indicator(1)			
Commodity	Applied		MFN		Absolute difference(2)		Relative position(3)	
(Stages)	Pre-UR	Post-UR	Pre-UR	Post-UR	Applied	MFN	Applied	MFN
Pig meat					Decreased	Decreased	*	*
Primary	0.03	0.03	6.03	5.13				
Semi-finished	2.53	2.50	2.57	2.51				
Processed	3.01	2.92	2.37	2.27				
Poultry					Decreased	Decreased	Decreased	Decreased
Primary	4.08	4.08	4.08	4.08				
Semi-finished	10.08	9.76	10.09	9.77				
Processed	9.20	6.35	10.30	6.70				
Meats of cow & lamb					Decreased	Decreased	Increased	Increased
Primary	0.79	0.39	1.22	0.62				
Semi-finished	6.88	6.57	7.44	6.57				
Processed	6.51	5.89	9.93	6.20				
Fish					Decreased	Decreased	Increased	Decreased
Primary	4.51	3.46	6.43	5.20				
Semi-finished	6.93	6.86	8.53	8.23				
Processed	8.84	7.02	12.63	9.88				
Shellfish					Increased	Increased	Increased	Increased
Primary	2.77	1.91	5.05	3.29				
Processed	7.60	7.27	12.09	11.39				
Wheat					Decreased	Decreased	Decreased	Decreased
Primary	2.10	2.10	2.10	2.10				
Semi-finished	0.10	0.05	0.10	0.05				
Processed	4.93	4.69	6.64	6.04				
Rice					*	*	*	*
Primary	5.48	5.42	5.55	5.49				
Processed	1.27	1.20	2.63	2.24				
Fruit					Decreased	Decreased	Decreased	Decreased
Primary	7.53	7.23	5.52	5.14				
Processed	13.77	11.31	16.41	13.03				
Vegetables					*	*	*	*
Primary	7.99	6.37	9.46	7.26				
Processed	5.12	4.35	9.20	6.93				
Coffee					Decreased	Decreased	Increased	Increased
Primary	0.83	0.27	2.53	0.42				
Processed	4.39	3.70	12.75	7.13				
Cocoa					Increased	Increased	Increased	Increased
Primary	0.11	0.01	2.09	0.01				
Semi-finished	5.00	3.37	5.90	3.73				
Processed	12.70	12.60	16.40	15.94				
Sugar					Increased	Increased	Increased	Increased
Primary	5.56	3.81	8.11	6.10				
Semi-finished	7.36	7.25	7.94	7.83				
Processed	8.37	7.80	10.61	9.50				

Table 5-A continued.

	Tariff rates				Change in escalation indicator(1)			
Commodity	Applied		MFN		Absolute difference(2)		Relative position(3)	
(Stages)	Pre-UR	Post-UR	Pre-UR	Post-UR	Applied	MFN	Applied	MFN
Groundnuts					Decreased	Decreased	Decreased	Decreased
Primary	0.63	0.63	0.67	0.63				
Processed	2.27	1.59	9.84	6.43				
Copra					Decreased	Decreased	Decreased	Decreased
Primary	0.15	0.15	0.15	0.15				
Processed	1.93	1.77	3.73	2.45				
Palm & Kernels					Decreased	Decreased	*	*
Primary	0.00	0.00	0.00	0.00				
Processed	2.78	2.23	4.34	3.15				
Soya beans					*	*	*	*
Primary	6.20	3.71	6.20	3.71				
Processed	4.03	2.97	4.32	3.14				
Lineseed					Decreased	Decreased	Decreased	*
Primary	1.70	1.70	3.56	3.56				
Processed	4.22	3.33	4.99	3.56				
Cotton seed					Decreased	Decreased	Increased	Increased
Primary	0.01	0.00	0.01	0.00				
Processed	3.20	2.29	14.20	9.33				
Castor seed					Decreased	Decreased	Decreased	Decreased
Primary	0.00	0.00	0.00	0.00				
Processed	1.80	1.49	2.79	1.65				
Tobacco					Decreased	Decreased	Decreased	Decreased
Primary	10.09	8.02	14.99	11.82				
Processed	57.32	40.37	82.29	40.64				
Wood					Decreased	Decreased	Increased	Increased
Primary	0.22	0.13	0.22	0.13				
Semi-finished	0.36	0.29	0.39	0.30				
Processed	2.73	1.94	7.39	4.91				
Cork					Increased	Decreased	Increased	Increased
Primary	0.97	0.28	1.03	0.32				
Semi-finished	1.18	0.24	1.83	0.24				
Processed	1.88	1.26	2.64	1.59				
Paper					Decreased	Decreased	Decreased	Decreased
Primary	0.33	0.33	0.37	0.36				
Semi-finished	0.33	0.15	0.50	0.17				
Processed	4.33	1.91	6.26	2.45				
Rubber					Decreased	Decreased	Increased	Decreased
Primary	0.45	0.34	0.46	0.34				
Semi-finished	2.29	1.60	4.43	2.06				
Processed	3.49	2.65	6.74	4.47				
Leather					Decreased	Decreased	Increased	Increased
Primary	0.21	0.13	0.22	0.13				
Semi-finished	4.63	4.16	7.73	6.38				
Processed	8.85	8.27	12.62	10.37				

Table 5-A continued.

Commodity	Applied		MFN		Absolute difference(2)		Relative position(3)	
(Stages)	Pre-UR	Post-UR	Pre-UR	Post-UR	Applied	MFN	Applied	MFN
Feather					*	Increased	Increased	Increased
Primary	0.56	0.01	1.63	0.01				
Processed	0.31	0.22	5.07	3.58				
Horn & bone					Decreased	Decreased	Decreased	Decreased
Primary	0.00	0.00	0.01	0.01				
Processed	0.80	0.72	7.11	4.94				
Hairs					Decreased	*	Decreased	*
Primary	0.04	0.02	1.27	0.57				
Processed	0.15	0.00	2.85	0.14				
Silk					Increased	Increased	Increased	Increased
Primary	5.00	1.87	5.00	1.87				
Semi-finished	2.51	2.41	6.36	6.05				
Processed	5.56	4.19	7.74	5.84				
Jute					Increased	Decreased	Increased	Increased
Primary	0.60	0.36	0.60	0.36				
Semi-finished	2.00	1.31	2.88	1.45				
Processed	2.25	2.03	4.18	3.50				
Wool					Decreased	Decreased	Increased	Increased
Primary	0.28	0.14	0.28	0.14				
Semi-finished	3.63	2.51	6.16	4.26				
Processed	5.03	3.83	12.97	9.70				
Cotton					Decreased	Decreased	Increased	Increased
Primary	0.25	0.15	0.25	0.15				
Semi-finished	2.55	1.91	6.89	4.61				
Processed	5.84	4.88	10.38	8.41				
Flax & hemp					Decreased	Decreased	Increased	Increased
Primary	0.32	0.19	1.78	0.19				
Processed	6.68	5.30	8.30	6.61				
Phosphate					Decreased	Decreased	Decreased	Decreased
Primary	0.00	0.00	0.00	0.00				
Semi-finished	4.35	2.76	5.55	3.87				
Processed	4.83	4.80	10.98	7.92				
Sulphur					Decreased	Decreased	Decreased	Increased
Primary	0.47	0.47	0.48	0.47				
Semi-finished	3.46	2.60	4.16	3.22				
Processed	16.53	16.50	17.16	17.13				
Asbestos					*	Decreased	Increased	Increased
Primary	2.82	1.69	2.82	1.69				
Processed	2.61	2.19	5.19	3.38				
Glass					Decreased	Decreased	Decreased	Decreased
Primary	0.16	0.16	0.16	0.16				
Semi-finished	2.47	1.97	3.38	2.53				
Processed	2.00	1.67	5.97	4.42				

Table 5-A continued.

	Tariff rates				Change in escalation indicator(1)			
Commodity	Applied		MFN		Absolute difference(2)		Relative position(3)	
(Stages)	Pre-UR	Post-UR	Pre-UR	Post-UR	Applied	MFN	Applied	MFN
Iron					Decreased	Decreased	Decreased	Decreased
Primary	0.10	0.10	0.10	0.10				
Semi-finished	3.94	2.04	5.95	2.34				
Processed	5.34	2.46	6.95	2.56				
Manganese					Decreased	Decreased	Decreased	Decreased
Primary	0.00	0.00	0.00	0.00				
Processed	17.02	15.20	17.54	15.51				
Copper					Decreased	Decreased	Decreased	Decreased
Primary	0.09	0.09	0.11	0.11				
Semi-finished	0.72	0.57	0.63	0.59				
Processed	2.37	2.18	4.15	3.45				
Nickel					Decreased	Decreased	Decreased	Decreased
Primary	0.09	0.09	0.11	0.09				
Semi-finished	1.57	0.52	2.02	0.52				
Processed	2.10	1.13	2.48	1.27				
Bauxite					Decreased	Decreased	Decreased	Decreased
Primary	0.04	0.04	0.04	0.04				
Semi-finished	1.18	1.10	2.26	1.66				
Processed	2.55	2.15	5.64	4.43				
Lead					Increased	Decreased	Increased	Decreased
Primary	1.21	1.00	1.47	1.22				
Processed	1.65	1.48	2.80	2.27				
Zinc					Decreased	Decreased	*	*
Primary	0.00	0.00	0.04	0.00				
Semi-finished	1.32	1.03	2.09	1.74				
Processed	1.95	1.47	5.21	3.57				
Tin					Decreased	Decreased	*	*
Primary	0.00	0.00	0.00	0.00				
Semi-finished	0.12	0.12	0.17	0.16				
Processed	0.99	0.65	2.16	1.24				
Tungsten					Decreased	Increased	Increased	Increased
Primary	0.25	0.12	4.15	2.08				
Processed	4.08	3.50	4.91	4.07				
Silver					Decreased	*	Decreased	Decreased
Primary	0.06	0.05	0.07	0.06				
Semi-finished	0.04	0.03	0.07	0.03				
Processed	0.16	0.01	2.63	0.69				
Petroleum					Decreased	Decreased	Decreased	Decreased
Primary	0.21	0.21	0.27	0.27				
Processed	2.88	2.86	5.41	4.87				

(1) Two indicators have been used as measures of the extent of change in tariff escalation: the absolute difference between the relevant average trade-weighted tariffs on the processed and primary stages of production only (i.e., excluding the semi-finished stage); and the relative position of the two averages.

(2) The absolute difference is calculated as follows: |post-UR tariff on the final stage - post-UR tariff on the primary stage| - |pre-UR tariff on the final stage - pre-UR tariff on the primary stage|. If the formula returns a negative number, this is taken as evidence that the UR Agreements has reduced the incidence of tariff escalation practices.

(3) The relative position is calculated as follows: (post UR tariff on the final stage/post UR tariff on the primary stage) - (pre UR tariff on the final stage/pre UR tariff on the primary stage). Once again, if the formula returns a negative number, this is taken as evidence that the UR Agreements have reduced the incidence of tariff escalation practices.

Table 5-B: List of products that experienced an increase in tariff escalation relative to Pre-Uruguay Round

Absolute difference		Relative position	
Applied	MFN	Applied	MFN
Cocoa	Cocoa	Asbestos	Asbestos
Cork	Feather	Cocoa	Cocoa
Jute	Shellfish	Coffee	Coffee
Lead	Silk	Cork	Cork
Shellfish	Sugar	Cotton	Cotton
Silk	Tungsten	Cotton seed	Cotton seed
Sugar		Feather	Feather
		Fish	Flax & hemp
		Flax & hemp	Jute
		Jute	Leather
		Lead	Meats of cow & lamb
		Leather	Shellfish
		Meats of cow & lamb	Silk
		Rubber	Sugar
		Shellfish	Sulphur
		Silk	Tungsten
		Sugar	Wood
		Tungsten	Wool
		Wood	
		Wool	

Table 6. Pre-Uruguay Round average trade-weighted applied tariff rates on imports from all sources for selected LDCs

	INDONESIA		MALAYSIA		PHILIPPINES		THAILAND	
Processing Chain	Primary	Final	Primary	Final	Primary	Final	Primary	Final
Pig meat	7.5	48.9	0.0	8.9	10.0	50.0	20.0	60.0
Poultry	7.5	49.1	5.0	9.0	40.0	50.0	20.0	60.0
Meat of cows and lamb	6.0	43.1	0.0	8.3	10.0	50.0	24.0	60.0
Fish fresh	29.1	46.2	0.0	36.7	20.0	42.0	60.0	60.0
Shellfish fresh	30.0	35.0	26.7	44.3	50.0	20.0	60.0	60.0
Wheat	0.0	33.0	1.3	11.7	10.0	40.0	0.0	60.0
Rice	0.0	0.0	0.0	0.5	0.0	50.0	0.0	0.0
Fruit	30.0	30.0	0.0	25.0	50.0	43.5	0.0	60.0
Vegetables	19.8	23.5	5.6	17.9	40.3	36.1	54.8	56.9
Coffee	25.0	30.0	5.0	18.3	50.0	50.0	0.0	60.0
Cocoa	10.0	60.0	30.0	22.8	30.0	50.0	0.0	60.0
Sugar	10.0	49.0	0.0	30.0	0.0	50.0	0.0	60.0
Groundnuts	30.0	10.0	0.0	5.0	20.0	40.0	35.0	0.0
Copra	5.0	10.0	5.0	5.0	0.0	0.0	0.0	0.0
Palm nuts, kernels	10.0	10.0	0.0	2.0	0.0	0.0	35.0	0.0
Soya beans	10.0	15.0	0.0	5.0	10.0	23.3	47.5	0.0
Lineseed	0.0	20.0	2.0	3.0	20.0	23.3	35.0	0.0
Cotton seed	10.0	0.0	5.0	5.0	0.0	40.0	35.0	0.0
Castor seed	0.0	20.0	0.0	3.5	0.0	45.0	35.0	30.0
Tobacco	15.0	27.2	0.0	0.0	50.0	45.0	60.0	60.0
Wood	15.0	30.0	17.1	24.3	10.0	35.3	10.0	50.0
Cork	5.0	8.6	na	12.5	na	20.0	na	32.0
Rubber	5.0	22.4	11.3	29.9	22.4	32.5	34.1	40.9
Leather	3.9	56.4	3.0	31.5	10.0	46.4	30.0	89.7
Feathers	9.2	32.7	3.4	35.0	25.0	47.8	31.5	50.0
Horn & whalebone	10.0	43.8	2.4	18.3	36.7	37.9	35.0	55.9
Hair	9.2	na	3.4	na	25.0	na	31.5	na
Silk	0.0	55.7	5.0	30.0	20.0	40.0	10.0	80.0
Jute	9.7	26.7	6.9	2.0	20.0	40.0	44.4	80.0
Wool	5.0	42.8	1.4	26.7	20.0	42.9	30.0	92.9
Cotton	2.5	55.9	1.0	27.6	10.0	40.9	5.0	81.5
Flax	5.0	8.8	2.0	2.8	0.0	30.0	30.0	30.0
Phosphate	0.0	2.9	2.0	1.3	10.0	8.3	15.0	30.0
Sulphur	0.0	5.9	2.0	4.8	10.0	19.2	10.0	30.0
Asbestos	0.0	6.3	0.0	7.9	20.0	30.0	12.5	46.4
Iron	0.0	4.4	2.0	6.4	10.0	15.5	10.0	20.9
Manganese	5.0	3.2	2.0	6.0	10.0	11.4	10.0	0.0
Copper	5.0	8.6	2.0	2.7	10.0	15.7	12.0	21.4
Bauxite	5.0	19.9	0.0	24.8	10.0	23.3	10.0	29.8
Lead	0.0	10.4	2.0	3.0	0.0	20.0	0.0	19.7
Zinc	0.0	10.0	2.0	5.0	0.0	20.0	0.0	21.9
Tin	0.0	9.0	0.0	5.0	0.0	20.0	10.0	19.7
Tungsten	5.0	5.0	2.3	2.9	10.0	10.0	10.0	23.5
Silver	1.8	0.0	20.0	10.0	0.0	50.0	0.0	35.0
Petroleum	0.0	5.7	0.0	4.0	10.0	22.0	25.0	29.2
*Percentage of chains where escalation occurs	81.3		79.2		77.1		66.7	
*Average primary and processed stages tariff differences (%)	16.3		9.0		16.0		18.7	

APPENDIX 1

Table A1 provides details on the commodity processing chains which form the basis for this study's empirical analysis. Each individual commodity is classified as falling in the primary, intermediate or final stage of a processing chain. To assist in clearly defining the nature of each item, its Standard International Classification (SITC) Revision 1 number is also given.[16]

A point to note is that chains defined in Table A are based on the SITC system and therefore may have certain limitations. One problem is that some of the SITC-based stages define products at too high a level of aggregation with the result that product composition may vary in ways that influence the empirical analysis. For example, the primary and processed stages of the fruit and vegetable chains may contain different proportions of (say) temperate and tropical products so they need not accurately represent a given (well-defined) commodity undergoing increased fabrication. A second problem concerns leakages from the chain. In these cases a given commodity experiences further processing, but is not used as a direct input into the next highest stage item. As a result, analysis of trade changes in SITC-defined processing chain may understate the actual level of commodity processing and trade by developing countries. Finally, the SITC system may contain some product groups that contain individual items which are at different levels of fabrication. As an example, the vegetable oil stages of the groundnut, Lineseed, soya bean, copra, and cotton seed chains do not distinguish between crude and refined oils although different levels of processing are involved.

Several of the commodities listed in Table A have end uses at the primary or intermediate stages of processing. For these items, a processing chain analysis may show little progress in shifting exports to higher levels of fabrication. Soya beans are an example as the primary stage item is a feed product. Vegetable, fruits, fish, and shellfish are other processing chains where a strong consumer preference may exist for the fresh (un-processed) stage of the product --a factor that would work against processing (preservation) in exporting countries.

A final point to note is that there may be major differences in the number of stages that are identified for the processing stages listed in Table A and this is often due to the nature of the SITC system. For example, several commodities like fruits, vegetable and fish have only a primary and final stage

[16] As an example, Table A1 shows that the cocoa chain has three distinct stages with cocoa beans (SITC 072.1) representing the primary stage (unprocessed) product. Cocoa powder (SITC 072.2) and cocoa butter (072.3) are two items classified in the next highest stage of processing, while chocolate (SITC 073) represents an even higher level of processing activity. For products like wood manufactures it is possible to identify five different levels of commodity fabrication although some other chains, like petroleum, have only a primary and processed stage.

identified as SITC products. This contrasts with the wood (manufactures) chain where a primary stage, two intermediate, and two final stages can be identified. As a result of these differences, it is very difficult to make cross-commodity comparisons of trade at similar levels of fabrication.

Appendix Table 1: Elements of the World Bank's Commodity Processing Classification Schemes & sources of unit value information

Processing chain	Primary stage product (SITC)	Intermediate product(s) (SITC)	Final stage product(s) (SITC)
		I. FOODSTUFFS AND TOBACCO	
Pig meat	Live swine (001.3)	Fresh or frozen pork (011.3)	Preserved pork (012.1, 013)
Poultry	Live poultry (001.4)	Fresh or frozen poultry (011.4, 011.81)	Prepared or tinned meat (013)
Meat of cows, sheep or goats	Live cattle, sheep or goats (001.1, 001.2)	Fresh or frozen beef or mutton (011.1, 00.2)	Meat tinned or smoked (012 less 012.1 013)
Fish other than shellfish	Fresh or frozen fish (031.1)	none identified	Salted or preserved fish (031.2, 032.01)
Shellfish	Fresh or frozen shellfish (031.3)	none identified	Prepared or preserved shellfish (032.02)
Wheat	Unmilled wheat (041)	Wheat meal or flour (046)	Bread or biscuits (048.41)
Rice	Rice in husk or husked (042.1)	none identified	Rice glazed or polished (042.2)
Fruit	Fresh fruit (051)	none identified	Preserved fruit (053)
Vegetables	Fresh vegetables (054)	none identified	Preserved vegetables (055)
Coffee	Green or roasted beans (071.1)	none identified	Coffee extracts (071.3)
Cocoa	Raw or roasted beans (072.1)	Cocoa powder and butter (072.2, 072.3)	Chocolate (073)
Tea	Tea (074.1)	none identified	Tea extracts (099.02)
Sugar	Raw beet and cane sugar (061.1)	Refined sugar (061.2)	Flavored sugar and sugar candy (062)
Groundnuts	Groundnuts (221.1)	none identified	Groundnut oil (421.4)
Copra	Copra, excl. flour and meal (221.2)	none identified	Coconut oil (422.3)
Palm nuts and kernels	Palm nuts and kernels (221.3)	none identified	Palm kernel oil (422.4)
Soya beans	Soya bean excl. flour (221.4)	none identified	Soya bean oil (421.2)
Linseed	Linseed excl. flour (221.5)	none identified	Linseed oil (422.1)
Cotton seed	Cotton seed excl. flour (221.6)	none identified	Cotton seed oil (421.3)
Castor seed	Castor seed excl. flour (221.7)	none identified	Castor oil (422.5)
Tobacco	Unmanufactured tobacco (121)	none identified	Cigars, cigarettes, etc. (122)

Appendix Table 1, continued

Processing chain	Primary stage product (SITC)	Intermediate product(s) (SITC)	Final stage product(s) (SITC)
		II. AGRICULTURAL MATERIALS	
Wood	Rough logs (242.21, 242.31)	Logs roughly square (242.22, 242.32) Lumber swan and planed (243)	Plywood and veneer (631.1, 631.2) Wood manufactures (632)
Cork	Cork unworked (244.01)	Cork simply worked (244.02)	Cork manufactures (633)
Paper-pulpwood	Pulpwood (242.1)	Woodpulp (251.2, 251.6, 251.7, 251.8)	Paper (641.1 to 641.4, 641.7, 641.9) Paper articles (641.1 to 642.3, 642.9)
Rubber	Natural and synthetic rubber (231.1, 231.2)	Unvulcanized rubber (621.01 to 621.03) Vulcanized rubber (621.04 to 621.06)	Tires, tubes and belts (629.1, 629.4, 655.45) Rubber clothing (841.6)
Leather	Hides and skins (211 less 211.8, 211.9)	Bovine and sheep leather (611.3, 611.4, 611.91, 611.92) Chamois and parchment leather (611.93, 611.94)	Leather belting (612.1, 612.2, 612.9) Leather clothing (841.3, 851.02)
Feathers	Feathers (291.96)	none identified	Feather goods (899.26, 899.92)
Horn and whalebone	Horn and whalebone (291.12)	none identified	Carved horn and whalebone (899.15)
Hair	Human hair (291.91)	none identified	Human hair worked (899.94)
Silk	Raw silk (261.3)	Silk yarn and thread (651.1)	Silk fabrics (653.1)
Jute	Raw jute (264)	Jute yarn (651.9)	Jute fabrics (653.4)
Wool	Wool greasy (262.1) Wool degreased (262.2, 262.6, 262.8)	Combed and carded wool (651.21, 651.22, 651.25)	Wool fabrics (653.21, 653.22) Wool blankets (656.61)
Cotton	Raw cotton (263.1) Cotton combed and carded (263.4)	Cotton yarn (651.3, 651.4)	Cotton fabrics (652.11 to 653.13, 652) Cotton blankets (656.62)
Flax, hemp and ramie	Raw flax, hemp and ramie (265.1 to 265.3)	none identified	Flax, hemp and ramie yarn (651.5)

Appendix Table 1, continued

Processing chain	Primary stage product (SITC)	Intermediate product(s) (SITC)	Final stage product(s) (SITC)
		III. ORES, MINERALS AND METALS	
Phosphate	Natural phosphate (271.3)	Phosphoric esters (512.63)	Phosphoric acid (513.35) Phosphate fertiliser (561.2)
Sulphur	Sulphur (274.1)	Esters and purified Sulphur (512.61, 513.2)	Sulfuric acid and compounds (513.33, 513.42)
Asbestos	Crude asbestos (276.4)	none identified	Asbestos fiber and material (661.83, 663.8)
Glass	Sand excl. metal bearing (273.3)	Glass in mass (664.11, 664.13, 664.3) Glass surface ground (664)	Safety or construction glass (664.5 to 664.7) Glass manufactures (664.91 to 664.93, 665.1, 665.2)
Iron	Iron ore (281.3)	Pig iron (671.2) Iron wire and rod (673)	Iron and steel place (674.1 to 674.3) Iron strip, rails, wires (675, 676, 677)
Manganese	Manganese ore (283.7)	none identified	Ferro-manganese (674.1)
Copper	Copper ore (283.11, 283.12)	Copper unrefined (682.11) Copper refined (682.12, 682.13)	Copper bars, wire, plate (686)
Nickel	Nickel ore (283.21, 283.22)	Unwrought nickel (683.1)	Nickel bars and sheet (683)
Bauxite	Bauxite ore (283.3)	Aluminium oxide (513.65) Unwrought aluminium (684.1)	Aluminium bars, plate, wire (684.2 less 684.24)
Lead	Lead ores (283.4)	Unwrought lead (685.1)	Lead bars, plate, wire (685.2)
Zinc	Zinc ores (283.5)	Unwrought zinc (686.1)	Zinc bars, plate, wire (686.2)
Tin	Tin ores (283.6)	Unwrought tin (687.1)	Tin bars, plate, wire (687.2)
Tungsten	Tungsten ore (283.92)	none identified	Tungsten (689.41)
Silver	Silver ore (285.01)	Unworked silver (681.11)	Rolled silver (681.12)
		IV. PETROLEUM	
Petroleum	Crude petroleum (331.01)	none identified	Gasoline, kerosene, fuels (332.1/2, 332.3/4)

Appendix Table 2: Trends in the relative importance of OECD countries' imports of primary and processed commodities from LDCs, 1980-94 (US$ Billions).

A- Primary commodities

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Australia	0.9	0.7	1.2	0.5	0.6	0.5	0.5	0.7	0.7	0.7	0.7	0.9	1.1	1.2	1.3
Canada	2.8	3.2	2.4	2.3	2.2	2.0	1.6	1.5	1.6	1.9	2.0	1.9	1.8	2.2	2.4
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan	33.7	29.7	27.2	25.8	25.0	23.7	19.6	21.9	24.2	25.7	28.7	27.6	26.4	26.7	28.7
Mexico	0.3	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.4
New Zealand	0.2	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.2	0.3	0.1	0.2	0.2	0.3
Norway	0.7	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.5	0.5	0.5	0.5	0.5	0.3	0.4
Switzerland	0.9	0.8	0.9	0.9	0.8	0.9	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.7
Turkey	2.0	2.2	2.3	2.4	2.7	2.7	1.3	2.7	2.5	2.4	2.5	0.6	0.9	1.3	1.2
USA	37.0	34.1	27.4	25.5	25.2	24.4	20.5	23.6	20.7	27.1	31.1	24.9	25.6	26.1	27.3
EU15	72.0	53.4	54.2	52.2	54.3	55.7	43.1	45.9	44.7	50.7	59.0	56.2	53.4	44.6	49.3
OECD imports from LDCs															
Primary	150.5	125.2	116.4	110.3	111.8	110.6	88.2	97.6	95.9	109.9	125.7	113.6	110.6	103.5	112.0
Non-oil primary	52.4	44.9	42.1	41.3	45.7	45.7	51.0	52.8	57.8	59.0	60.7	61.7	60.6	57.7	67.3
Memo items															
* OECD imports from world															
Primary	362.1	346.4	297.5	258.6	261.1	247.3	200.3	229.1	228.3	255.7	303.6	293.7	295.6	274.2	289.8
Non-oil primary	107.1	97.0	90.4	86.8	93.2	92.7	105.3	117.0	131.1	135.5	143.2	145.4	147.5	136.1	154.6
* LDCs imports from world															
Primary	84.5	91.7	82.6	79.7	75.0	70.0	52.5	62.8	65.9	76.5	86.2	84.3	91.9	85.6	91.3
Non-oil primary	22.9	31.1	26.5	27.7	26.3	25.3	25.5	32.4	39.8	43.3	43.1	43.8	46.9	43.6	51.7
* Total world imports															
Primary	446.6	438.1	380.0	338.3	336.1	317.3	252.8	291.9	294.1	332.2	389.7	378.0	387.5	359.7	381.1
Non-oil primary	130.0	128.0	116.9	114.5	119.4	118.0	130.7	149.5	170.9	178.8	186.3	189.2	194.4	179.6	206.3

Appendix Table 2, continued
B- Processed commodities

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Australia	1.1	1.1	1.1	0.8	1.0	0.9	0.8	0.9	1.1	1.0	0.9	1.0	1.1	1.1	1.3
Canada	0.7	0.9	0.7	0.9	1.1	1.0	1.0	1.3	1.5	1.8	1.8	1.8	1.7	1.7	1.7
Iceland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japan	5.0	5.4	5.2	5.3	6.6	6.1	5.5	8.0	6.7	7.9	7.2	8.3	11.0	11.9	13.0
Mexico	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.1	0.3	0.4	0.5	0.5	0.9
New Zealand	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.3
Norway	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
Switzerland	0.3	0.3	0.3	0.2	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.4	0.4
Turkey	0.4	0.4	0.1	0.2	0.3	0.2	0.3	0.3	0.4	0.4	0.5	0.4	0.3	0.6	0.4
USA	14.1	15.7	14.9	17.3	22.3	20.0	18.2	20.7	22.5	21.7	24.1	21.5	22.5	22.9	23.8
EU15	17.7	15.3	15.2	14.5	15.1	15.9	14.3	18.4	19.4	20.3	24.2	25.1	24.3	22.3	24.4
OECD imports from LDCs															
Final	40.1	39.6	38.1	39.6	47.3	45.1	41.0	50.6	52.5	54.1	59.9	59.3	62.5	61.9	66.6
Non-oil final	19.8	20.0	18.8	20.3	25.2	24.4	27.5	34.9	42.2	43.7	47.8	49.6	50.7	51.6	57.7
Memo items															
* OECD imports from world															
Processed	162.5	155.6	151.0	152.2	168.5	169.1	167.9	201.8	209.5	222.0	257.6	252.7	265.1	241.3	262.7
Non-oil proce.	100.8	93.9	88.9	89.3	101.9	104.2	125.1	152.2	175.2	184.6	209.5	209.7	220.0	200.1	227.8
* LDCs imports from world															
Processed	40.7	45.6	38.1	38.2	34.4	34.3	32.5	46.3	51.8	62.2	71.3	76.9	82.0	85.9	93.8
Non-oil proce.	27.3	30.3	23.5	24.9	23.3	23.6	24.5	36.7	42.5	48.6	51.0	57.6	61.1	65.5	74.3
* Total world imports															
Processed	203.2	201.2	189.2	190.4	202.9	203.4	200.4	248.2	261.4	284.1	328.9	329.6	347.1	327.3	356.5
Non-oil proce.	128.1	124.2	112.4	114.1	125.1	127.8	149.6	188.9	217.7	233.2	260.5	267.4	281.1	265.6	302.1

The growth rates have been computed using the least-squares method. The least-squares growth rate, r, is estimated by fitting a regression trend line to the logarithmic annual values of the variable in the relevant period. More specifically, the regression equation takes the form $\log X_t = a + b_t + e_t$, where this is equivalent to the transformation of the compound growth rate equation, $X_t = X_0 (1+r)^t$. In these equations, X is the variable, t is time and $a = \log X_0$ and $b=\log(1+r)$ are the parameters to be estimated; e is the error term. If b* is the least-squares estimate of b, then the average annual percentage growth rate, r, is obtained as [antilog(b*)]-1 and is multiplied by 100 to express it as a percentage.

Appendix Table 3: 1994 OECD countries' imports of primary and processed commodities from LDCs (US$ Millions).

	OECD		Australia		Canada		Iceland		Japan		Mexico	
Commodity (SITC)	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final
Food & feeds	49,258.53	14,378.45	381.99	240.13	1,094.22	425.24	8.69	2.99	12,040.54	4,028.67	246.21	150.01
Pig meat (0121)	2.92	1.17	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.03	N.A.	N.A.	0.00
Poultry (013)	5.88	964.29	N.A.	0.46	N.A.	12.32	N.A.	N.A.	0.35	176.17	0.03	1.29
Meats of cow & lamb (012-0121)	208.18	6.81	N.A.	0.00	0.00	N.A.	N.A.	N.A.	0.06	0.26	2.66	N.A.
Fish (0312,03201)	5,784.19	3,136.88	50.59	52.28	43.39	79.29	0.00	0.53	3,214.41	1,276.90	7.64	8.47
Shellfish (03202)	9,492.21	1,190.69	101.69	43.74	154.01	58.94	0.27	0.02	4,554.74	531.58	11.82	5.48
Wheat (04841)	162.24	187.15	0.02	9.25	0.00	5.45	N.A.	0.00	N.A.	49.34	0.00	0.11
Rice (0422)	701.93	787.20	0.04	12.58	1.03	25.69	0.00	0.11	556.91	400.32	N.A.	31.72
Fruit (053)	9,579.95	4,257.83	38.37	43.76	383.99	145.00	5.49	1.81	720.55	775.40	82.28	46.06
Vegetables (055)	3,726.73	1,619.97	20.79	24.90	36.42	41.43	0.24	0.34	1,042.15	560.23	1.92	3.51
Coffee (0713)	9,031.81	311.85	88.77	11.56	309.97	20.90	2.59	0.00	923.01	85.22	12.84	5.50
Cocoa (073)	2,993.69	134.24	0.07	1.80	40.20	4.84	N.A.	0.00	54.28	75.92	0.04	4.40
Tea (09902)	864.32	30.65	41.00	0.18	16.82	0.16	0.07	0.00	131.73	5.11	0.21	0.02
Sugar (062)	1,819.99	176.63	0.11	9.84	50.49	10.50	0.01	0.02	258.17	13.57	12.26	9.45
Groundnuts (4214)	491.15	188.62	5.94	0.78	38.25	0.20	0.02	0.00	36.12	0.99	21.54	0.00
Copra (4223)	43.06	645.10	0.01	7.90	0.00	11.29	N.A.	0.00	13.15	23.28	N.A.	4.49
Palm & kernels (4224)	11.03	400.69	0.01	1.85	0.01	8.67	N.A.	N.A.	0.94	34.23	0.01	1.80
Soya beans (4212)	2,276.12	104.10	0.02	14.90	0.14	0.02	0.00	N.A.	330.87	0.97	86.50	25.75
Linseed (4221)	2.90	3.87	N.A.	1.43	N.A.	N.A.	N.A.	N.A.	N.A.	0.08	N.A.	0.82
Cotton seed (4213)	52.18	8.23	N.A.	0.00	N.A.	N.A.	N.A.	N.A.	3.94	N.A.	0.69	N.A.
Castor seed (4225)	13.69	106.14	N.A.	0.88	N.A.	0.28	N.A.	0.01	0.22	14.44	N.A.	1.08
Tobacco (122)	1,994.37	116.35	34.55	2.05	19.51	0.27	N.A.	0.15	198.91	4.68	5.76	0.07
Agricultural materials	8,796.07	37,540.03	61.87	920.72	132.52	961.48	0.07	10.62	3,160.85	5,401.65	106.52	399.64
Wood (6311,6312,632)	3,031.79	6,770.92	0.17	96.62	0.46	92.31	0.05	0.85	1,940.40	2,455.36	3.67	68.40
Cork (633)	33.41	492.54	0.27	28.37	0.03	4.17	N.A.	0.14	2.73	19.44	0.72	1.07
Paper	13.16	1,917.64	N.A.	136.26	N.A.	41.90	N.A.	0.93	N.A.	162.72	N.A.	41.70
Rubber (6291,6294,65545,8416)	3,220.47	3,568.99	53.84	178.56	120.27	128.56	N.A.	2.34	685.74	185.89	75.84	88.39
Leather	401.41	18,485.89	0.89	251.78	0.34	537.30	0.00	5.75	5.06	1,447.75	4.69	109.22
Feathers (89926,89992)	413.96	22.14	4.85	0.20	4.95	0.51	0.00	0.00	215.78	3.98	N.A.	0.09
Horn & bone (89915)	16.75	65.83	0.01	0.48	0.12	0.62	N.A.	0.00	5.42	31.74	0.01	0.10

Appendix Table 3, continued

	OECD		Australia		Canada		Iceland		Japan		Mexico	
Commodity (SITC)	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final
Hairs (89994)	2.43	10.37	N.A.	0.02	0.01	0.35	N.A.	N.A.	0.78	0.79	N.A.	N.A.
Silk (6531)	198.95	608.96	N.A.	13.74	0.06	17.62	N.A.	0.03	65.73	198.39	0.02	1.59
Jute (6534)	17.53	109.72	0.62	9.08	0.23	3.19	0.00	0.11	1.90	11.72	0.00	0.13
Wool (65321,65322,65661)	584.66	200.01	0.25	6.34	4.50	25.58	N.A.	0.00	134.18	20.69	6.09	9.55
Cotton (65211..65213,652,65662)	837.99	5,088.20	0.87	197.39	1.54	107.72	N.A.	0.48	96.31	849.09	15.47	79.23
Flax & hemp (6515)	23.57	198.81	0.11	1.89	0.01	1.63	0.01	N.A.	6.83	14.09	0.02	0.16
Ores & minerals	9,218.85	8,780.99	66.53	119.67	213.32	91.27	0.00	0.41	3,757.61	2,840.82	78.25	256.26
Phosphate (51335,5612)	532.53	557.21	21.00	3.97	27.65	0.95	N.A.	0.00	53.75	24.38	48.16	8.58
Sulphur (51333,51342)	18.39	19.68	0.00	0.83	N.A.	0.01	N.A.	N.A.	0.52	0.03	0.00	0.61
Asbestos (66183,6638)	65.36	58.87	N.A.	3.11	0.05	3.49	N.A.	0.02	41.32	13.22	4.27	3.02
Glass (6645..6647,66491..66493,6651, 6652)	34.26	920.96	0.04	51.24	0.01	29.24	N.A.	0.26	21.95	90.87	0.01	18.58
Iron (6741..6743,675..677)	3,842.19	2,142.37	21.73	40.41	8.97	25.48	N.A.	0.02	1,613.32	844.64	1.17	76.38
Manganese (6741)	315.89	763.12	0.01	6.01	N.A.	15.70	N.A.	0.02	72.87	314.94	2.02	21.59
Copper (686)	2,423.84	207.67	15.47	0.38	83.70	0.16	N.A.	0.00	1,566.40	35.04	8.87	0.04
Nickel (683)	339.05	313.36	N.A.	0.82	0.96	3.33	N.A.	N.A.	257.64	112.76	N.A.	1.37
Bauxite (6842-68424)	814.43	3,744.20	0.96	10.11	67.02	12.07	N.A.	0.08	26.50	1,395.17	1.16	125.19
Lead (6852)	252.97	1.78	5.10	0.01	11.71	0.04	N.A.	0.00	47.40	0.14	11.76	0.00
Zinc (6862)	380.14	21.87	2.17	0.03	4.88	0.16	N.A.	0.00	45.98	2.40	N.A.	0.04
Tin (6872)	1.65	7.54	N.A.	2.27	0.05	0.38	N.A.	0.00	N.A.	0.40	0.85	0.61
Tungsten (68941)	14.61	21.07	N.A.	0.47	N.A.	0.27	N.A.	N.A.	0.78	6.83	N.A.	0.25
Silver (68112)	183.54	1.30	0.05	0.01	8.31	0.01	N.A.	N.A.	9.18	N.A.	N.A.	N.A.
Petroleum (3321..3324)	44,713.06	8,894.73	762.44	N.A.	918.50	181.23	N.A.	N.A.	9,773.28	2,087.30	N.A.	199.18
Total all above	111,986.50	69,594.20	1,272.83	1,280.53	2,358.56	1,659.22	8.76	14.02	28,732.28	14,358.43	430.99	1,005.08

Appendix Table 3 Continued:

	New Zealand		Norway		Switzerland		Turkey		USA		EU(15)	
Commodity (SITC)	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final
Food & feeds	93.03	59.86	249.13	56.59	495.83	169.21	106.97	98.48	9,957.43	3,083.87	24,584.50	6,063.40
Pig meat (0121)	N.A.	N.A.	N.A.	N.A.	N.A.	0.00	N.A.	N.A.	N.A.	N.A.	2.89	1.17
Poultry (013)	N.A.	0.46	N.A.	0.84	0.00	6.91	1.21	0.01	N.A.	261.33	4.29	504.52
Meats of cow & lamb (012-0121)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	2.68	N.A.	0.03	6.53	202.75	0.02
Fish (0312,03201)	1.06	7.00	0.99	4.66	15.98	30.00	8.73	0.13	986.75	450.30	1,454.65	1,227.33
Shellfish (03202)	5.94	7.19	4.67	2.48	15.71	5.03	1.19	N.A.	2,682.88	278.63	1,959.31	257.61
Wheat (04841)	0.00	0.38	0.00	0.15	1.13	0.77	0.17	0.05	0.51	52.12	160.41	69.51
Rice (0422)	0.03	1.38	0.09	3.58	0.11	3.89	0.04	32.24	12.08	132.27	131.61	143.42
Fruit (053)	37.80	17.22	89.99	29.90	152.97	63.79	27.33	3.14	2,344.19	946.01	5,697.00	2,185.74
Vegetables (055)	7.08	2.76	14.02	9.90	41.72	33.67	4.02	0.43	284.85	326.03	2,273.51	616.78
Coffee (0713)	18.87	0.97	110.92	1.78	141.12	2.06	16.80	0.12	1,957.76	64.37	5,449.17	119.39
Cocoa (073)	0.27	0.47	4.02	0.01	44.21	0.45	29.84	0.05	503.27	18.19	2,317.50	28.12
Tea (09902)	7.01	0.00	0.80	0.00	2.64	1.04	2.13	N.A.	120.85	12.76	541.05	11.38
Sugar (062)	0.30	2.16	0.08	0.78	2.17	0.45	N.A.	N.A.	594.54	85.68	901.85	44.19
Groundnuts (4214)	5.68	0.14	0.21	0.00	3.35	12.54	1.41	N.A.	0.12	5.30	378.51	168.66
Copra (4223)	N.A.	4.18	N.A.	2.42	N.A.	2.57	0.09	4.17	0.00	238.38	29.82	346.42
Palm & kernels (4224)	N.A.	0.19	N.A.	N.A.	N.A.	2.12	N.A.	15.98	0.85	93.04	9.21	242.82
Soya beans (4212)	0.00	14.85	15.06	0.00	10.91	0.00	N.A.	41.65	0.49	2.11	1,832.12	3.85
Linseed (4221)	0.00	0.37	0.00	0.00	0.07	N.A.	N.A.	N.A.	0.00	0.45	2.83	0.71
Cotton seed (4213)	N.A.	N.A.	N.A.	N.A.	0.04	0.00	11.34	N.A.	0.13	7.81	36.03	0.42
Castor seed (4225)	N.A.	0.10	N.A.	0.05	N.A.	0.86	N.A.	0.48	N.A.	33.05	13.47	54.91
Tobacco (122)	8.99	0.04	8.28	0.03	63.70	3.07	N.A.	0.04	468.13	69.52	1,186.54	36.43
Agricultural materials	11.78	157.68	24.12	235.96	46.12	245.67	275.21	145.24	1,228.39	14,752.30	3,748.61	14,309.08
Wood (6311,6312,632)	0.13	8.19	22.61	25.10	3.84	12.76	54.40	9.00	14.16	1,606.07	991.90	2,396.25
Cork (633)	0.00	4.71	0.02	1.49	0.17	15.52	0.16	0.27	2.94	78.39	26.37	338.97
Paper (6411..6414,6417,6419,6421..6423,6429)	N.A.	27.15	N.A.	6.87	N.A.	10.51	N.A.	6.13	N.A.	526.33	13.16	957.16
Rubber (6291,6294,65545,8416)	10.25	27.77	0.79	22.40	1.63	23.10	70.27	14.70	1,099.41	1,493.84	1,102.43	1,403.45
Leather (6121,6122,6129,8413,85102)	N.A.	47.52	0.03	147.16	0.01	167.65	59.88	11.36	10.78	9,279.57	319.73	6,480.84
Feathers (89926,89992)	1.13	0.03	0.11	0.31	5.88	0.27	0.02	0.02	74.30	7.66	106.94	9.07

Appendix Table 3, continued

	New Zealand		Norway		Switzerland		Turkey		USA		EU(15)	
Commodity (SITC)	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final	Primary	Final
Horn & bone (89915)	N.A.	0.08	0.00	0.03	0.44	0.65	N.A.	0.04	0.63	16.86	10.12	15.23
Hairs (89994)	N.A.	0.00	N.A.	0.00	0.00	0.01	N.A.	0.00	0.66	7.98	0.98	1.21
Silk (6531)	N.A.	1.52	0.06	0.80	1.56	5.09	1.22	0.60	5.06	126.72	125.24	242.87
Jute (6534)	N.A.	2.42	0.04	0.03	N.A.	0.58	2.57	6.19	3.62	29.93	8.56	46.37
Wool (65321,65322,65661)	0.00	2.56	N.A.	0.15	3.63	0.55	7.81	0.62	12.30	57.37	415.90	76.59
Cotton (65211..65213,652,65662)	0.27	35.13	0.44	31.62	28.97	8.75	77.89	84.48	4.11	1,515.72	612.12	2,178.59
Flax & hemp (6515)	N.A.	0.62	0.02	0.00	N.A.	0.23	0.97	11.84	0.43	5.87	15.17	162.49
Ores & minerals	22.64	36.86	124.64	29.35	0.71	31.13	65.59	95.19	823.92	1,709.56	4,065.64	3,570.47
Phosphate (51335,5612)	21.77	10.01	9.63	0.01	0.04	0.16	20.64	43.71	31.20	12.99	298.70	452.45
Sulphur (51333,51342)	0.36	0.00	N.A.	N.A.	0.01	N.A.	N.A.	0.00	0.83	0.12	16.67	18.08
Asbestos (66183,6638)	N.A.	0.30	N.A.	0.07	N.A.	0.01	5.57	0.55	0.15	13.72	14.01	21.37
Glass (6645..6647,66491..66493,6651, 6652)	N.A.	7.08	0.00	3.88	0.09	7.57	0.65	1.44	1.38	271.32	10.12	439.47
Iron (6741..6743,675..677)	N.A.	10.59	N.A.	2.46	0.39	4.99	32.93	17.22	213.48	577.54	1,950.20	542.64
Manganese (6741)	N.A.	3.39	28.86	0.42	N.A.	1.04	0.17	3.89	28.17	133.87	183.80	262.26
Copper (686)	N.A.	1.01	N.A.	0.24	N.A.	0.01	N.A.	0.65	82.12	96.13	667.29	74.01
Nickel (683)	N.A.	0.03	77.13	0.04	N.A.	0.01	N.A.	0.22	0.63	85.29	2.70	109.50
Bauxite (6842-68424)	0.51	3.98	1.61	22.12	N.A.	17.30	5.32	27.11	387.51	510.51	323.84	1,620.57
Lead (6852)	N.A.	0.07	N.A.	N.A.	N.A.	0.01	N.A.	0.00	70.23	0.59	106.76	0.92
Zinc (6862)	0.01	0.05	7.41	0.00	N.A.	0.01	0.30	0.05	2.93	2.15	316.45	16.98
Tin (6872)	N.A.	0.36	N.A.	0.03	N.A.	0.02	N.A.	N.A.	N.A.	0.36	0.75	3.10
Tungsten (68941)	N.A.	0.00	N.A.	0.08	N.A.	0.01	N.A.	0.34	5.29	4.97	8.54	7.86
Silver (68112)	N.A.	N.A.	N.A.	N.A.	0.19	N.A.	N.A.	N.A.	0.00	0.02	165.82	1.27
Petroleum (3321..3324)	131.51	N.A.	9.77	12.02	197.76	4.27	716.56	80.11	15,279.19	4,685.72	16,924.05	1,644.91
Total all above	258.96	254.40	407.65	333.92	740.42	450.28	1,164.32	419.03	27,288.94	24,231.44	49,322.80	25,587.86

ANNEX II

Review of Past Literature on Tariff Escalation

It should be noted that, for the studies referred to below, historical data has been used which in most cases bears no resemblance to the post Uruguay Round situation. With that caveat, the section below surveys the findings of these studies.

One of the earliest works is Golub and Finger (1979). They compared the magnitude and effect of developing country export taxes with developed country import tariffs. Their model was based on estimates of six factors; demand for processed goods in developed and developing countries and supply of raw materials and processed goods in developed and developing countries. (Because they did not want to assume that all countries are price takers, they did not base their analysis on effective rates of protection.) They analyzed the impact of removing each set of tariffs separately, and the impact of removing both import and export tariffs simultaneously.

The results[17] showed that removing the developed country import duties would sharply increase processing in developing countries, and slightly decrease it in developed countries. Removing only the developing country export duties - those which protect processing - not surprisingly projected sharp decreases in processing in the developing world and slight increases in the developed world. Removing both sets of duties would increase developing countries' processing activity substantially, though not as much as a simple removal of import duties.

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[17] Their results may be summarized as follows:

Table 2. Impacts of removing escalating and de-escalating tariffs

Overall effect of:	% change in final consumption			% change in primary production		% change in processing		change in LDC export revenue	
	LDC+DC	LDC	DC	LDC	DC	LDC	DC	$M	% change
Removing DC import taxes	.7	-2.2	1.2	1.3	.4	23.0	-3.8	1615.5	16.3
Removing LDC export taxes	.0	-1.6	.3	2.7	-1.3	-14.7	2.9	-412.7	-4.3
Removing all taxes	.7	-3.8	1.5	4.0	-.9	8.3	-.9	1202.8	12.1

Source: From Golub and Finger (1979) Tables 3, 4, and 5.

Yeats (1984) considered in more detail the methodology for analyzing the extent of bias created by escalating tariffs. Working from the definition of effective protection, he argued that the impact of any particular set of tariffs depends not only on their nominal or effective rates, but also on the price elasticity of demand for the good at each stage of processing. If demand for processed goods is more elastic than demand for raw materials (as it usually is), then even a uniform import tariff structure would lead to bias against imported processed goods relative to imported raw materials. If demand were much less price-elastic for processed goods than for raw materials, then an apparently escalating tariff structure could still lead to a net bias in favor of processed goods rather than raw materials. Thus estimates of the impact of escalating nominal or effective tariffs on the distribution of production must take into account the elasticity of demand for each good in addition to the tariff rate.

Laird and Yeats (1987) used Yeats' (1984) result in analyzing the impact of developing country import tariffs on developing country trade, attempting to determine whether developing country policies created the same biases against processing activities by exporters as did developed country policies. They used a somewhat different approach from other studies. In particular, to calculate average tariffs for product groups, they weighted the nominal tariffs by potential free trade in the absence of any tariffs, rather than by actual trade data. This approach permitted them to incorporate Yeats' conclusions about the importance of demand elasticities in their calculation of average tariffs. It also allowed them to avoid distortion in the averages when an extremely high tariff essentially prevented all trade; using actual trade weights this would show up as a very low tariff for the product group in question. They applied both the conventional method and their modified approach to nineteen commodity processing chains. Their approach showed substantially more escalation for most chains than tariff averages calculated using actual trade data. Overall, they found that developing countries generally had far higher import tariff escalation than did developed countries.

Laird and Yeats then assessed the impact of preferential removal of developing country import tariffs in favor of other developing countries. They used the UNCTAD Trade Policy Simulation Model, which projects the value of trade creation based on initial level of imports between two given countries, initial tariff rates, and the elasticities of import demand and export supply. They carried out their projections of the impact of preferential tariffs under three supply elasticity assumptions; perfect elasticity, a supply elasticity of 3.0, and unitary elasticity. With perfectly elastic supply, the share of developing country goods in overall (non-petroleum) LDC imports rose 3.2 percentage points; with unitary elasticity it rose 2.1 percentage points. With perfectly elastic supply, this increase was estimated to entail a rise of almost four percentage points in the share of processed goods in total (non-petroleum) trade among developing countries. The largest increases in trade of processed goods would occur in textiles, rubber and leather; in contrast, tariff preferences would have little impact on processing of food products.

Laird and Yeats focused on the increase in the amounts of processing by developing countries in each chain, and the share which processing represented in total developing country output. This meant that exporters' processed goods increased as a share of total trade. They did not provide information about changes in either the amount or the share of exported primary production under each scenario. Therefore it is hard to draw conclusions from their analysis about the likely net impacts on the environment

Among more recent (but still pre-Uruguay Round) studies, Clark (1985) examined developed and developing country tariff escalation, comparing GSP and MFN rates in the tariffs on oilseeds and vegetable oils. First, comparing *ad valorem* tariff averages calculated using actual trade data, he found that GSP beneficiaries faced overall lower tariffs than MFN beneficiaries on both seeds and oils in six out of eight developed country markets. Tariffs escalated substantially in almost all of the markets, though there was not a consistent pattern in whether the escalation fell more heavily on GSP or MFN beneficiaries. Nominal tariffs on soyabeans and soyabean oil for fourteen major developing country importers showed much higher, though less steeply escalating, rates than those of the developed countries. Clark then modelled the impact of a removal of all major importing country tariffs. His model takes into account the fact that developing countries will lose from this because they no longer benefit from preferential GSP tariffs, while at the same time they gained from the overall removal of tariffs. The former factor can divert trade to former MFN beneficiaries, who are not in a better position relative to former GSP beneficiaries. The latter factor will create new trade as purchases shift from domestic production to imports.

He found that the combined impact of these two factors on developing country exports was marginal; assuming infinitely elastic export supplies, the change in value of exports was less than 1.5% of the base period. The paper did not disaggregate impacts on primary and processed goods from the removal of tariff escalation; however the overall results suggested that neither would be very large. The resulting impacts on the environment were likely to be correspondingly small.

Yeats (1987) provided summary data on the magnitude of escalating trade barriers against developing countries in 1985, for sixteen product groups. His data highlight differences between developed and developing country tariffs and between tariff and non-tariff barriers. Developed country average tariffs are based on applied MFN and GSP rates. Developing country tariffs are based on MFN rates as applied by some thirty countries. Developed country tariff rates are almost all below 10% for both primary and processed goods. The only higher values are for processed vegetables, fruit, tobacco, and sugar, where the highest rate is 20%. In contrast, almost all of the developing country tariffs are at levels at least twice those of developed countries, and often substantially more. All tariffs escalate, though those of developing countries escalate more steeply. Thus all tariffs were probably creating a bias against processing, those applied by developing countries are relatively more pronounced.

Yeats' data on non-tariff barriers show only the share of trade affected by the barriers. The data base identified substantially more non-tariff barriers in developed countries than in developing countries. In five sectors (meat, fish, vegetables, fruit, and sugar), the share of trade covered by developed country NTBs declines very sharply with the level of processing. Developing country NTBs touch less trade overall, though they show similar de-escalation on four of those five sectors (meat, fish, vegetables, and fruit). All NTB coverage escalates on tobacco, vegetable oils, wood products, cotton, and iron; in most of these sectors it covers more of the imports of developing than of developed countries. Thus while NTBs may create significant biases either for or against processing, we cannot generalize about their impact on output.

Safadi and Yeats (1993) focus on the impacts of trade barrier escalation in intra-Asian trade. From average (apparently nominal) tariff data for ten countries and for forty-eight processing chains, they conclude that tariff escalation is important in most processing chains and countries (except Hong Kong, with no tariffs). In addition, non-tariff barriers contribute to discrimination against processed goods, particularly in the foods, feeds, and agricultural materials sectors.

The Uruguay Round reduced some tariff escalation, though not all, according to GATT (1994). The GATT work employed a simple approach for identifying the direction of change in tariff escalation, based on looking at change in the "tariff wedge"; that is, the change in absolute difference between nominal tariffs on processed and primary goods. Without having to estimate effective rates of protection under old and new tariffs, which would be very difficult when many tariff rates change at once, this method does at least let us see the direction of changes after the Uruguay Round. The paper applies this approach to the pre- and post-Uruguay Round tariffs imposed by developed countries on goods imported from developing countries. Table 3 shows the overall conclusions, based both on absolute reductions of nominal tariffs and on the decrease in the wedges between primary, intermediate, and final goods. This suggests that, on the whole, developed country tariff escalation dropped with the Uruguay Round. However, in a few goods the intermediate to final stage wedge has increased, meaning an increase in tariff escalation.

Table 3. Developed country tariff escalation pre- and post-Uruguay Round

	Pre-Uruguay Round			Post-Uruguay Round			absolute reduction in tariffs	change in 2-stage wedge
	tariff	1-stage wedge	2-stage wedge	tariff	1-stage wedge	2-stage wedge		
Industrial products excluding petroleum								
raw material	2.1			0.8			1.3	
semi-processed	5.4	3.3		2.8	2.0		2.6	
finished	9.1	3.7	7.0	6.2	3.4	5.4	2.0	-1.6
Tropical industrial products								
raw material	0.1			0.0			0.1	
semi-processed	6.3	6.2		3.4	3.4		2.9	
finished	6.6	6.5	6.5	2.4	-1.0	2.4	4.2	-4.1
Natural resource-based products excluding petroleum								
raw material	3.1			2.0			1.1	
semi-processed	3.5	0.4		2.0	0.0		1.5	
finished	7.9	4.4	4.8	5.9	3.9	3.9	2.0	-0.9

Source: Adapted from GATT (1994) Table II.5, p. 15

The forestry sector: impacts of de-escalating export barriers

Bourke (1988) carried out a detailed analysis of the impact of trade barriers on developing country trade in forest products. Using data on post-Tokyo Round tariffs of eleven developed countries, he points out significant escalation in tariffs between wood in the rough, primary products, and secondary products. Developing country tariffs were generally (though not always) higher than those of developed countries. The pattern of escalation varied substantially across importers. Data on *ad valorem* tariffs imposed by a group of ASEAN countries also show steady escalation from wood in the rough to intermediate products to furniture, with rates generally substantially higher than those of developed countries. Estimates of effective protection for five countries (USA, EEC, Japan, Italy, and Indonesia), which Bourke compiled from several sources, are significantly higher than for nominal protection. Indonesia shows the highest rates of effective protection of the five countries, although the data from different sources may not be comparable.

Bourke suggests a number of factors inherent in wood processing which may add to the impact of escalating tariffs. Raw materials extraction and primary processing are typically more labor-intensive than secondary processing, giving labor-surplus developing countries a comparative advantage. Primary products tend to be more standardized, so price and supply availability play a key role in international markets. In contrast, processed goods are more specialized, their production tolerances are narrow and quality requirements higher, and their design, packing and promotion are more important. These factors call for greater skill in production and marketing, which may be less available in developing than in developed economies. While Bourke continues to see tariff escalation as a source of bias, he nevertheless also provides data suggesting that, even if tariffs were neutral, developing countries might not have a comparative advantage in processing activities. A similar point is made by Fitzgerald (1986), who questions whether holding a dominant position in log production is sufficient to give Indonesia a comparative advantage in wood processing.

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