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COMMITTEE ON COMMODITY PROBLEMS

INTERGOVERNMENTAL GROUP ON MEAT AND DAIRY PRODUCTS

SUB-GROUP ON HIDES AND SKINS

Eighth Session

Rome, 18-19 December 2003

LINKAGES BETWEEN TRADE AND ENVIRONMENTAL POLICIES IN THE HIDES AND SKINS AND LEATHER SECTOR

I. BACKGROUND

1. At its seventh Session in June 2001, the Sub-Group requested the Secretariat to undertake an empirical analysis of the impact of environmental regulations and trade restrictions on the hides and skins and leather sector. This document has been prepared in response to that request. The impact of environmental regulations, pollution prevention and pollution abatement costs is examined by means of a partial equilibrium model that provides a stylized picture of the hides and skins, light leather and footwear global markets. Leather processing is a polluting activity with the tanneries and leather finishing sector being amongst the most toxic industrial sectors¹. An increase in the stringency of environmental regulations is thought of as having implications for the location of the industry as abatement costs may shift leather processing away from countries with stringent regulations.

2. In the second half of the paper, the discussion focuses on trade liberalization. Trade policy reform is a priority issue in the World Trade Organisation (WTO) negotiations, as trade liberalisation is viewed as encouraging economic welfare and long run growth. The analysis was

¹ Hettinge, H., P. Martin, M. Singh and D. Wheeler (1995). The Industrial Pollution Projection System. The World Bank, Policy Research Department.

carried out by means of the partial equilibrium model of hides and skins and leather products. Such models are increasingly used to address sensitive policy issues, such as the impact of trade liberalisation on production, consumption and trade, the location of industries, as well as on the distribution of benefits and costs across countries and population groups.

II. IMPACT OF ENVIRONMENTAL REGULATIONS

A. BACKGROUND

3. The extent to which environmental regulations across countries determine the location of the processing industry depends on the stringency of the regulations and the corresponding abatement costs. As a generalisation, there is evidence to suggest that developing countries that support their domestic processing sector have environmental standards that are inferior to those prevailing in developed countries, as lower incomes are likely to lead to weak demand for higher standards that improve environmental outcomes. Stringent environmental regulations may have resulted in a relative shift of the leather processing industry from developed to developing countries in the past, as the abatement costs of compliance with the regulations might have exerted pressure on profitability.

4. However, the relocation of the industry to regions where environmental regulations are more stringent would only take place if these abatement costs were significant relative to total costs of processing. It is estimated that clean-up costs in European plants might be 3-5 percent of running costs². An earlier UNIDO estimate suggested that effluent treatment costs were about 4-6 percent of final costs³. Technological developments, as well as the operation of large numbers of tanning plants within 'clusters' have resulted in a reduction in the abatement costs. In the United States, total expenditure on disposal and recycling capita in the leather processing industry for 1999 amounted to US\$1 million, whilst the operating costs for abatement amounted to US\$11.8 million⁴. Based on this data, it is estimated that the average cost for abating pollution that accrued from processing 1 000 square feet of light leather in the US amounts to approximately US\$17.10.

5. Presumably, abatement costs in developing countries, where the same stringent standards generally are not met, would be lower, but may rise above 5 percent of operating costs if an attempt was made to meet developed country standards without the technology available in developed countries. Given that tanning and leather processing technologies in developing countries may be relatively less modern and thus more polluting than those in developed countries, abatement costs in developing countries may be considerably higher if stringent standards are to be met.

B. SIMULATION OF AN INCREASE IN THE STRINGENCY OF ENVIRONMENTAL REGULATIONS

6. The analysis of the impact of the increase in the stringency of environmental regulations was carried out by using a partial equilibrium model that covers bovine hides, light leather and footwear sectors in regions of developing and developed countries. In brief, partial equilibrium models provide a statistical picture of the economy and capture the interactions between supply, demand, trade and prices. The bovine hides and leather products model was developed by the Raw Materials, Tropical and Horticultural Products Service of FAO, utilising in-house data series on production, apparent availability and trade⁵ and information on import tariffs from the World

² FAO 2001, 'Trade, Sanitary and Environmental Policy Linkages in the Hides and Skins and Leather Processing Sector', CCP: ME/HS 01/3, Rome.

³ FAO 1994, 'Environmental aspects of processing and trade in hides, skins and leather', CCP: ME/HS 94/9, Rome.

⁴ US Census Bureau 1999, Pollution Abatement Costs and Expenditures, Washington.

⁵ World Statistical Compendium for Raw Hides and Skins, Leather and Leather Footwear, 2001

Integrated Trade Simulator of the World Bank (WITS)⁶. The model is static and thus presents only a long term equilibrium situation expected to prevail after adjustment to the new market conditions has been completed.

7. An increase in the stringency of environmental regulations will result in a corresponding increase in abatement costs. Environmental regulations for the leather processing industry often consist of maximum values for air emissions, liquid effluents and solid wastes per unit of production. An increase in the regulations' stringency would reflect a decrease in these maximum values. Without precise knowledge of the maximum values in the United States, as well as of the abatement cost structure, or the relationship between the amount of the pollutant abated and the costs of the treatment technologies per unit of pollutant, it is not possible to calculate the abatement costs that correspond to a proportional increase in the stringency of the environmental regulations. Nevertheless, under the assumption that average abatement costs in North America, Europe, Oceania and the Other Developed countries are similar to those of the United States, a simulation experiment of an increase of 200 percent in the abatement costs in these regions was carried out in order to explore the sensitivity of leather processing to changes in the environmental regulations in developed countries.

8. Assuming that the tanning industry in developed countries will be forced to absorb the 200 percent increase in abatement costs, without passing the increase on to the consumers, an increase in input costs by an amount of US\$34.20 to US\$51.30 per 1 000 square feet of light leather was simulated. The extent to which tanners respond to increases in abatement costs was assumed to be similar to the extent to which they respond to changes in the price at which they sell leather. This is a rather simplistic approach as the response of the leather industry to increases in input costs depends on its cost structure and the corresponding profitability. However, the specification of a more complex model that would include the relationship between input costs and production was not possible due to the lack of data and information on the cost structure of the leather processing industry. Therefore, the simulation results may be thought of as providing an indication of the impact of stricter environmental standards and should be interpreted with caution.

Table 1 – Impact of a 200 percent increase in developed countries' abatement costs on production, consumption and net trade of light leather (percentage changes)

| | Consumption | Production | Net exports | Net imports |
|-----------------------------|-------------|------------|-------------|-------------|
| Developing countries | | | | |
| Latin America | -0.30 | 0.21 | 1.17 | |
| Africa | -0.73 | 0.21 | .. | -8.46 |
| Near East | -0.61 | 0.06 | .. | -16.30 |
| Far East | -0.36 | 0.06 | .. | -1.28 |
| Developed countries | | | | |
| North America | -0.49 | -1.26 | -2.39 | .. |
| Europe | -0.46 | -1.34 | -6.82 | .. |
| F. Soviet Union | -0.36 | 0.21 | .. | -4.93 |
| Oceania | -0.36 | -1.27 | -1.69 | .. |
| Developed, Other | -0.36 | -1.15 | -6.32 | .. |
| World | | -0.40 | | -1.63 |

Source: Bovine hides and leather products simulation model

⁶ Information on other trade policies, such as export taxes or other export restrictions often implemented by developing countries was not available. Therefore, only the elimination of import tariffs is examined.

9. The simulation results (see Table 1) suggest that the impact of an increase in the stringency of environmental standards in developed countries may be small. Production is simulated to decrease by approximately 1.3 percent in North America, Europe and Oceania and by 1.1 percent in Other Developed countries, suggesting that a small number of processing plants have actually suffered losses and ceased production. As production and exports from these countries decline, both domestic and international prices increase to restore market equilibrium both in the region and worldwide. Price increases cause demand to fall and production in other regions to increase. Africa and Latin America are simulated to increase production of leather by 0.2 percent, whilst the increase in Near East and Far East is insignificant.

10. A simulation of an increase in abatement costs in Africa, Far East and all developing regions was also carried out. For this experiment, it was assumed that developing countries have to meet the same regulations as those prevailing in developed countries. However, as developing countries may have more polluting technology as compared to that of developed countries, it was decided to simulate an increase of US\$68.40 in the abatement costs. Such an increase should adequately reflect an increase in the stringency of environmental standards given less modern leather processing technologies.

Table 2 – Impact of a 200 percent increase in Africa’s abatement costs on production, consumption and net trade of light leather (percentage change)

| | Consumption | Production | Net exports | Net imports |
|-----------------------------|-------------|------------|-------------|-------------|
| Developing countries | | | | |
| Latin America | -0.03 | 0.02 | 0.10 | .. |
| Africa | -0.06 | -2.42 | | 19.26 |
| Near East | -0.05 | 0.01 | | -1.36 |
| Far East | -0.03 | 0.01 | | -0.11 |
| Developed countries | | | | |
| North America | -0.04 | 0.03 | 0.12 | .. |
| Europe | -0.04 | 0.03 | 0.46 | .. |
| F. Soviet Union | -0.03 | 0.02 | .. | -0.41 |
| Oceania | -0.03 | 0.03 | 0.05 | .. |
| Developed, Other | -0.03 | 0.03 | 0.39 | .. |
| World | | -0.03 | | 0.17 |

Source: Bovine hides and leather products simulation model

11. In Africa, the increase in abatement costs is simulated to result in a decrease of 2.4 percent in the production of leather, as a proportion of African processing firms may cease production when profits are squeezed (Table 2). Net imports of leather would also increase by 19 percent in order to cover the requirements of the domestic footwear and leather goods industry. Increased demand for imports by Africa would exert some weak upward pressure on the international price, resulting in very small increases in the production of leather in other regions.

12. A similar increase in abatement costs in Far East would result in a lower decrease in the region’s production, as compared to that simulated for Africa. The simulation results indicate that production of leather in the Far East region would decrease by only 0.7 percent, whilst imports would increase by 1 percent, suggesting that leather processing firms in Far East are able to absorb the increases in production costs (see Table 3). The increase in the demand for imports by Far East would exert a relatively stronger pressure on the international price, thus resulting in more notable increases in other regions’ leather production.

13. Table 4 presents the simulation results of an increase in the abatement costs of all developing regions. The simulation suggests that the increase in the stringency of environmental standards of developing countries may result in a 2.7 and 2.1 percent reduction in the quantity of

leather processed in Latin America and Africa respectively, suggesting that some processing firms may cease production. In Near East and Far East, production may decrease by approximately 0.6 percent. The decrease in the quantity of leather supplied in the world market is expected to result in an increase in the international price and a new equilibrium with increased production in the developed countries and reduced demand worldwide. North America and Europe may increase production by 0.4 and 0.5 percent respectively, whilst net exports from these regions are simulated to increase by 2.1 and 7.9 percent.

Table 3 – Impact of a 200 percent increase in Far East’s abatement costs on production, consumption and net trade of light leather (percentage change)

| | Consumption | Production | Net exports | Net imports |
|-----------------------------|-------------|------------|-------------|-------------|
| Developing countries | | | | |
| Latin America | -0.12 | 0.08 | 0.46 | .. |
| Africa | -0.29 | 0.08 | .. | -3.32 |
| Near East | -0.24 | 0.02 | .. | -6.41 |
| Far East | -0.14 | -0.69 | .. | 1.02 |
| Developed countries | | | | |
| North America | -0.19 | 0.12 | 0.57 | .. |
| Europe | -0.18 | 0.14 | 2.16 | .. |
| F. Soviet Union | -0.14 | 0.08 | .. | -1.94 |
| Oceania | -0.14 | 0.12 | 0.25 | .. |
| Developed, Other | -0.14 | 0.12 | 1.85 | .. |
| World | | -0.16 | | 0.80 |

Source: Bovine hides and leather products simulation model

Table 4 – Impact of a 200 percent increase in developing regions’ abatement costs on production, consumption and net trade of light leather (percentage change)

| | Consumption | Production | Net exports | Net imports |
|-----------------------------|-------------|------------|-------------|-------------|
| Developing countries | | | | |
| Latin America | -0.44 | -2.75 | -7.04 | .. |
| Africa | -1.06 | -2.13 | .. | 7.72 |
| Near East | -0.88 | -0.65 | .. | -6.28 |
| Far East | -0.53 | -0.62 | .. | -0.32 |
| Developed countries | | | | |
| North America | -0.70 | 0.44 | 2.11 | .. |
| Europe | -0.66 | 0.53 | 7.95 | .. |
| F. Soviet Union | -0.53 | 0.31 | .. | -7.14 |
| Oceania | -0.53 | 0.46 | 0.92 | .. |
| Developed, Other | -0.53 | 0.44 | 6.81 | .. |
| World | | -0.58 | | -0.48 |

Source: Bovine hides and leather products simulation model

14. The simulation results provide an indication that the impact of an increase in the stringency of environmental standards will have a very small effect on the location of the industry. This is consistent with earlier qualitative studies that suggest that although leather

processing is considered a relatively polluting industry, variations between countries in environmental standards may have only an insignificant impact on the location of the industry⁷.

III. IMPACT OF TRADE LIBERALIZATION

A. BACKGROUND

15. Trade measures, such as import tariffs and export taxes, import and export quotas and tariff rate quotas insulate domestic markets by driving a wedge between the domestic and the international prices and serve to transfer wealth from one population group to another. The objective of import tariffs and import quotas is to protect producers and processors. These policy instruments reduce the degree to which domestic producers or processors are exposed to changes in the international market and provide incentives to increase production by raising the domestic price at the expense of consumers. Such policies are applied for various reasons. The objective could be either to support the income of domestic producers or to protect an 'infant' industry until it becomes sufficiently well established to compete with developed industries in other countries. On the other hand, export quotas and export taxes aim at depressing the domestic price relative to the international price and redistribute wealth from producers to consumers. These policies aim at increasing the supply of raw materials to the domestic market, lowering prices to producers and domestic processors.

16. Table 5 presents the tariff rates for bovine hides, light leather and footwear that are implemented by regions of developing and developed countries. Market access in terms of tariffs is a major issue for both raw materials and processed products in markets of both developing and developed countries. Average import tariffs for raw bovine hides vary between 0 percent (North America and Oceania) and 11.7 percent (Africa). The pattern of tariff escalation is evident with the level of protection, expressed in tariff rates for the developed and the developing countries, increasing along the processing chain. Average tariffs for finished leather vary between 2.5 percent (Oceania) to 16.4 percent (Africa), whilst those for footwear vary between 5.6 percent (Area of Former Soviet Union) to 37.5 percent (Oceania).

Table 5 - Import tariffs for Bovine Hides, Leather and Footwear, 2002

| | Hides | | | Leather | | | Footwear | | |
|-----------------------------|---------|---------|---------|---------|---------|---------|----------|---------|---------|
| | Average | Minimum | Maximum | Average | Minimum | Maximum | Average | Minimum | Maximum |
| Developing countries | | | | | | | | | |
| Latin America | 1.9 | 0.0 | 15.0 | 6.7 | 0.0 | 15.0 | 19.9 | 0.0 | 35.0 |
| Africa | 11.7 | 5.0 | 20.0 | 16.4 | 5.0 | 38.0 | 32.2 | 1.0 | 60.0 |
| Near East | 0.6 | 0.0 | 30.0 | 9.4 | 0.0 | 35.0 | 19.7 | 0.0 | 50.0 |
| Far East | 1.3 | 0.0 | 15.0 | 10.6 | 0.0 | 30.0 | 18.9 | 5.0 | 75.0 |
| Developed countries | | | | | | | | | |
| North America | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.0 | 6.1 | 0.0 | 33.3 |
| Europe | 0.4 | 0.0 | 25.0 | 4.0 | 0.0 | 13.0 | 6.9 | 0.0 | 99.0 |
| F. Soviet Union | 1.6 | 0.0 | 12.0 | 5.1 | 0.0 | 15.0 | 5.6 | 0.0 | 30.0 |
| Oceania | 0.0 | 0.0 | 0.0 | 2.5 | 0.0 | 5.0 | 10.8 | 0.0 | 15.0 |
| Other Developed | 0.0 | 0.0 | 0.0 | 3.3 | 0.0 | 10.0 | 37.5 | 0.0 | 60.0 |

Source: World Integrated Trade Solution

⁷ FAO 2001, 'Trade, Sanitary and Environmental Policy Linkages in the Hides and Skins and Leather Processing Sector', CCP: ME/HS 01/3, Rome.

17. In theory, the elimination of tariff barriers for hides and skins and leather products is likely to increase global economic welfare as it encourages the production of these commodities to take place in regions and countries according to the law of comparative advantage and in line with the availability of resources, such as land, livestock herds, labour and technology. The removal of tariff barriers for raw hides, skins and leather products would be likely to lead to an increase in international prices of raw materials and processed products. Tariff elimination would result in a reduction in prices to consumers in countries that protect their markets, thereby stimulating demand for leather and leather products that in turn would strengthen international prices. Therefore, leather processing is likely to increase and its location is likely to shift following liberalisation.

18. The situation may be different in producing countries which have a large hitherto-protected domestic market, where liberalization would result, at least in the short term, in lower prices with an inflow of imports competing with domestic producers. In the long term, liberalization in these countries may result in increased revenues brought about by an increase in competitiveness and efficiency. In the past, Banse and Gerken (1992) quantified the impact of trade liberalisation in the hides and skins and leather product sector utilising a partial equilibrium model. This work was reported to the Third Session of the Sub-Group⁸. However, as the study was undertaken more than a decade ago, it was thought that a trade liberalisation simulation utilising recent data on tariffs, production, consumption and trade would be necessary in order to better highlight the extent to which trade liberalisation will affect both developed and developing regions.

19. It is important to note that as the bovine hides and leather products model covers regions and not individual countries, the results have to be interpreted with caution. Aggregation across countries and into regions results in a loss of information on the trade position of individual countries (i.e. whether a country is an exporter or an importer and the actual impact of the import tariff on the domestic market). For example, if a country imposes an import tariff of 20 percent on bovine hides but does not import any quantity, either because the country is self-sufficient or because it is an exporter, the tariff does not determine the domestic price. For this reason, it was assumed that the extent to which tariffs determine the domestic prices of importing regions depends on the quantity of imports as compared with consumption. Producers and consumers in important exporting regions were assumed to face the international market price.

⁸ Banse, M, and A. Gerken (1992). Impact of Protectionist Measures Affecting Imports and Exports of Hides and Skins and Their Derived Products. Agricultural Economics Institute, University of Göttingen.

B. THE IMPACT OF TRADE LIBERALIZATION

20. Table 6 presents the results of trade liberalization in the hides and skins sector. The elimination of tariffs would be expected to lead to a 9.3 percent increase in the world price for wet salted bovine hides benefiting exporting regions such as Africa, where tariffs are assumed not be effective. Importing regions that implemented high tariff rates such as the Near East are expected to experience a decline in the domestic price. The elimination of tariffs and the subsequent change in prices would result in changes in the quantities supplied, demanded and traded. Lower prices in regions that had high tariffs would stimulate demand. Global trade would increase by 4.4 percent and production would shift to regions with comparative advantage such as Africa. The African supply and net exports of bovine hides would grow by 7.5 and 36.7 percent respectively. Global economic welfare would increase albeit by a small rate. Bovine hides producers in Africa and some developed regions would gain, while those in regions that had high tariff rates, such as Near East and Europe, would be negatively impacted.

Table 6 - Trade liberalization * simulation results: Bovine hides (percentage change)

| | Price | Consumption | Production | Net exports | Net imports | Consumer welfare | Producer welfare | Total welfare |
|-----------------------------|--------|-------------|------------|-------------|-------------|------------------|------------------|---------------|
| Developing countries | | | | | | | | |
| Latin America | -0.59 | 0.12 | -0.03 | .. | 1.70 | 0.24 | -0.61 | 0.01 |
| Africa | 9.35 | -1.87 | 7.48 | 36.71 | .. | -3.70 | 16.16 | 0.69 |
| Near East | -15.89 | 2.86 | -0.79 | .. | 11.67 | 5.80 | -16.23 | 1.26 |
| Far East | -4.92 | 0.98 | -0.25 | .. | 3.11 | 1.98 | -5.04 | 0.57 |
| Developed countries | | | | | | | | |
| North America | 9.35 | -1.87 | 0.47 | 2.86 | .. | -3.70 | 9.61 | 2.03 |
| Europe | -12.52 | 1.63 | -0.63 | .. | 13.91 | 3.28 | -12.80 | 0.39 |
| F. Soviet Union | 9.35 | -1.87 | 0.47 | 2.27 | .. | -3.70 | 9.61 | 2.53 |
| Oceania | 9.35 | -1.87 | 0.47 | 1.65 | .. | -3.70 | 9.61 | 3.39 |
| Developed, Other | 9.35 | -1.87 | 0.47 | .. | -4.25 | -3.70 | 9.61 | -1.58 |
| World | 9.35 | 0.34 | 0.34 | 4.42 | 4.42 | 1.12 | -0.50 | 0.71 |

Source: Bovine hides and leather products simulation model

* Removal of all import tariffs

21. The results in Table 7 suggest that the elimination of tariffs in the light leather sector would increase global trade by 26.9 percent. The international price for light leather would increase by 19.2 percent. In spite of the increase in the international price, importing regions that applied high tariff rates and supported their domestic price at a high level would experience a decline in their *post* liberalization prices. In Africa, the elimination of tariffs that ranged from 5 to 38 percent would result in a 13.6 percent decline in their light leather price. Likewise, the Far Eastern domestic price would decline by 11.7 percent following the elimination of tariffs of between 9.4 and 35 percent. The leather sectors of exporting countries with little or no protection would experience a domestic price increase. In Latin America, the elimination of tariffs would lead to an increase in domestic prices of 8.35 percent. The decline in prices in developing importing countries would stimulate demand but also lessen the incentive for increased domestic production and, consequently, lead to an increase in imports. In Africa, imports of leather would increase from 29 million to 81 million square feet while those in the Near East would grow from 15 million to 48 million square feet. Growth in demand would be met by increased production in North America, Europe Oceania and Latin America. The model results also suggest that trade liberalization would lead to a 2.5 percent increase in global economic welfare. In Africa and Near East, leather consumer welfare would increase by 35.4 and 17.3 percent respectively.

Table 7 - Trade liberalization simulation results: Light leather (percentage change)

| | Price | Consumption | Production | Net exports | Net imports | Consumer welfare | Producer welfare | Total welfare |
|-----------------------------|--------|-------------|------------|-------------|-------------|------------------|------------------|---------------|
| Developing countries | | | | | | | | |
| Latin America | 8.35 | -4.17 | 2.92 | 16.11 | .. | -8.17 | 10.27 | 2.14 |
| Africa | -13.64 | 16.36 | -4.77 | ... | 189.56 | 35.40 | -16.13 | 2.51 |
| Near East | -8.32 | 8.32 | -0.83 | .. | 223.04 | 17.33 | -8.72 | 0.51 |
| Far East | -11.72 | 7.03 | -1.17 | .. | 24.62 | 14.55 | -12.26 | 2.83 |
| Developed countries | | | | | | | | |
| North America | 16.47 | -13.18 | 8.23 | 39.41 | .. | -24.62 | 22.86 | 7.16 |
| Europe | 5.47 | -4.10 | 3.28 | 49.37 | .. | -8.04 | 7.95 | 0.74 |
| F. Soviet Union | 3.64 | -2.18 | 1.27 | .. | -29.49 | -4.32 | 4.44 | -0.22 |
| Oceania | 13.51 | -8.10 | 7.02 | 14.13 | .. | -15.55 | 18.89 | 9.78 |
| Developed, Other | 8.35 | -5.01 | 4.17 | 64.51 | .. | -9.77 | 11.36 | 0.99 |
| World | 19.18 | 1.88 | 1.88 | 26.94 | 26.94 | 5.42 | -0.30 | 2.52 |

Source: Bovine hides and leather products simulation model

22. With regard to leather footwear, the results (Table 8) suggest that the elimination of import tariffs would lead to a 69.7 percent increase in trade and footwear manufacturing would shift from developed to developing countries. International prices would increase by 11.4 percent to an average of US\$14 539 per 1 000 pairs of shoes. However, in net importing regions with high tariffs, such as Europe and North America, domestic prices would fall as a result of liberalization thus leading to an expansion in demand but also weaken the incentive for increased domestic production. On the other hand, the net footwear exporting developing regions would benefit from the increase in international prices which would lead to increased supply and exports. In Africa, net exports would expand by 263.5 percent to about 43 million pairs of shoes while net exports from the Near East would increase to about 75 million pairs. Global economic welfare would increase by 8 percent. In the developing countries, the expected improvement in producer welfare would offset the decline in consumer welfare, resulting in a positive change in total economic welfare.

Table 8 - Trade liberalization simulation results: Footwear (percentage change)

| | Price | Consumption | Production | Net exports | Net imports | Consumer welfare | Producer welfare | Total welfare |
|-----------------------------|--------|-------------|------------|-------------|-------------|------------------|------------------|---------------|
| Developing countries | | | | | | | | |
| Latin America | 11.45 | -7.44 | 10.87 | 103.73 | .. | -14.33 | 22.99 | 2.45 |
| Africa | 11.45 | -34.34 | 9.73 | 263.50 | .. | -56.89 | 20.88 | 5.47 |
| Near East | 11.45 | -34.34 | 10.19 | 741.44 | .. | -56.89 | 21.68 | 4.34 |
| Far East | 11.45 | -11.45 | 11.45 | 54.65 | .. | -21.58 | 24.20 | 6.11 |
| Developed countries | | | | | | | | |
| North America | -16.21 | 12.96 | -12.96 | .. | 16.15 | 27.61 | -25.26 | 19.26 |
| Europe | -25.70 | 20.56 | -20.56 | .. | 73.60 | 45.35 | -38.43 | 7.40 |
| F. Soviet Union | -14.27 | 11.42 | -11.42 | .. | 69.94 | 24.14 | -22.43 | 2.47 |
| Oceania | -3.09 | 2.47 | -2.47 | .. | 5.00 | 5.00 | -5.09 | 2.41 |
| Developed, Other | -30.35 | 24.28 | -24.28 | .. | 59.38 | 54.45 | -44.44 | 14.19 |
| World | 11.45 | 1.47 | 2.97 | 69.74 | 69.74 | 14.80 | 0.26 | 8.03 |

Source: Bovine hides and leather products simulation model

IV. CONCLUSIONS

23. Trade liberalisation of the bovine hides and leather sectors could have a significant impact on the environment. Firstly, there is a scale effect of increased global output. This effect tends to increase pollution, although a more efficient use of resources may lower the pollution per unit of output. The second effect is compositional, as production would shift to regions that enjoy comparative advantage. However, within a country, the leather processing industry is quite polluting, and any increase in output of processed leather increases pollution to an extent determined by the implementation of the existing legislation, available technology and expenditure on abatement and treatment costs. In any case, the simulation exercise carried out in the first half of this paper, suggests that environmental regulations may not be a determining factor for the leather industry's location. A third impact relates to technology transfer. Trade reform which implies a more open economy is likely to encourage the implementation of better technologies, reducing the amount of pollution worldwide. In general, the simulations exercises undertaken in this paper suggest that the elimination of tariffs would lead to an increase in leather processing in the developed countries, whilst an increase in the stringency of environmental regulation would have a small impact on the location of the industry.