The Structure and Effects of Tariff and Nontariff Barriers in 1983

by

Edward E. Leamer
Department of Economics
UCLA
Los Angeles, CA 90024

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(213) 825-3557

Tariffs have relatively clear primary effects on product prices and arguable secondary effects on employment, earnings, profits, consumer welfare, etc. Nontariff barriers, on the other hand, have quite unclear effects on product prices, and largely unknown secondary effects. For those who find it desirable to know what their governments are doing, the apparent increase in nontariff barriers is thus a cause for concern. Indeed, it may be conjectured that the primary reason for nontariff barriers is precisely that their effects can only be guessed, and the resultant uncertainty diffuses the political response that would be made to tariffs of equal restrictiveness. Many will therefore welcome quantitative information on the restrictiveness of nontariff barriers.

This paper reports some results on the estimation of the effects of tariff and nontariff barriers using cross-section data collected in 1983. The theory on which the method of estimation rests is presented in Section 1. Section 2 describes the sources of the data that are analyzed. Section 3 discusses tables and graphs of the data. Section 4 reports the econometric estimates.

A fundamental problem facing the estimation of the effects of trade barriers is caused by the dimension of the data sets that might be analyzed. These data sets are very thin in terms of number of years of data, fairly thin in terms of the number of countries imposing trade barriers, and very thick in terms of the number of commodities. It is accordingly essential to use the cross-commodity variation to estimate the effects of the barriers. But relying on the cross-commodity experiment can be uncomfortable. This is like estimating a demand equation by comparing demand of different commodities. Suppose, for example, that apples face low barriers and have high imports, but oranges face high trade barriers and have low imports. Is this evidence that barriers deter trade? If you think so, suppose that the commodities were wheat and automobiles.

In other papers, Leamer(1988) and Leamer and Bowen(1981), I have shown that the traditional Heckscher-Ohlin-Vanek theory of trade offers a very insecure footing to these cross-commodity regressions. But in the absence of a longer time series, or more countries, we are forced to rely on what we have: lots of commodities. Accordingly, in this paper estimates of the effects of barriers are based partly on cross-country variability but also on cross-commodity variability of barriers and imports. A justification of this kind of regression is offered in Section 1 which presents a general equilibrium model with log-linear production and utility. This model implies that net exports of selected commodities depend on country and commodity scale variables, trade barriers, and interactions between country and commodity characteristics. The statistical models that are used to analyze the data set are loosely based on this general equilibrium model. One kind of model controls for difference in commodity and country with dummy variables. The other kind retains the commodity dummies but includes also interaction between measured country characteristics and commodity characteristics. Models are estimated with an overall measure of nontariff barriers and also barriers disaggregated into quantitative restrictions, price maintenance barriers, quality controls and threats.

The goal here is to estimate the impact that trade barriers have had on trade, and, in effect, to "score" countries according to their degree of "openness." Overall, barriers are estimated using one model to have reduced imports of the fourteen importers included in the data base by about four per cent, three per cent due to nontariff barriers and one per cent due to tariff barriers. A surprise is that although the Japanese have very frequent barriers, one estimated model suggests that these barriers have been largely ineffective. Disaggregation of the barriers leads to the conclusion that quality regulations have the greatest impact, which is a finding that offsets the conclusion that the Japanese barriers are relatively ineffective.

These results have to be viewed with some scepticism. The connection between the theory and the estimated model is weak enough to be uncomfortable. No attempt has been made to treat the simultaneous equations problem caused by the fact that barriers may be put in place in response to high import levels. The sensitivity analyses that should be carried out to support these inferences are limited. Nonetheless, the results are of interest, if only for pointing to the ways that data analyses can (and cannot) help us understand the effects of barriers.

1.0 A General Equilibrium Model

A theoretical foundation is important for any data analysis, especially one that tries to draw inferences about price elasticities from cross-commodity variation in prices and quantities. A natural starting point is the traditional general equilibrium model which is based on the assumptions: (1) identical homothetic tastes, (2) constant returns to scale and identical technologies, (3) perfect competition in the goods and factor markets, (4) costless international exchange of commodities (5) internationally immobile factors of production that can move costlessly among industries within a country, (6) equal numbers of goods and factors, and (7) sufficient similarities in factor endowments that countries are all in the same "cone of diversification". These assumptions imply that all countries have the same factor prices (factor price equalization), and identical input/output ratios.

The production side of the general equilibrium model can be summarized by the system of equations:

$$\mathbf{Q} = \mathbf{A}^{-1}\,\mathbf{V} \qquad (1)$$

$$\mathbf{w} = \mathbf{A}'^{-1}\mathbf{p} \qquad (2)$$

$$\mathbf{A} = \mathbf{A}(\mathbf{w}, t) \qquad (3)$$

where **Q** is the vector of outputs, **V** is the vector of factor supplies, **A** is the input-output matrix with elements equal to the amount of a factor used to produce a unit of a good, **p** is the vector of commodity prices, and **w** is the vector of factor returns. Equation (1), which translates factor supplies **V** into outputs **Q**, is the inverted form of the factor market equilibrium conditions equating the supply of factors **V** to the demand for factors **AQ**. Equation (2), which translates product prices into factor prices, is the inverted form of the zero profit conditions equating product prices p to production costs $A'w$. Equation (3) expresses the dependence of input intensities on factor prices w and on the state of technology t, $A(w,t)$ being the cost minimizing choice of input intensities at time t. The assumption of constant returns to scale implies that A depends on the factor returns w but not on the scale of output Q.

In the absence of barriers to trade, all individuals are assumed to face the same commodity prices, and if they have identical homothetic tastes, then they consume in the same proportions:

$$C = s\, C_w = s\, A^{-1} V_w \tag{4}$$

where C is the consumption vector, C_w is the world consumption vector, V_w is the vector of world resource supplies, and s is the consumption share. Thus trade is

$$T = Q - C = A^{-1} V - s\, A^{-1} V_w = A^{-1} (V - s\, V_w) \; . \tag{5}$$

The consumption share s will depend on the level of output and also on the size of the trade balance, $B = \pi' T$, where π is the vector of external prices which in the absence of trade barriers would equal the internal prices p. Premultiplying (5) by the vector of prices π and then rearranging produces the consumption share:

$$s = (\pi' A^{-1} V - B) / \pi' A^{-1} V_w = (GNP - B)/GNP_w, \tag{6}$$

This model without trade barriers is relatively "clean" because prices can be entirely hidden from view and no explicit commitment is necessary to a specific utility function and a specific set of production functions. This follows from the fact that all countries are assumed to face the same prices of traded goods and services. Given a suitable list of assumptions including identical constant-returns-to-scale technologies and equal numbers of traded goods and nontraded factors, it can then be shown that all countries have the same prices for the nontraded goods and services as well as for the traded goods and services. Then the input-output intensities **A**, which are generally price dependent, are the same for all countries, and for cross-country comparisons at a point in time prices can be suppressed.

When trade barriers are erected, the home prices of commodities must vary from country to country, and the effects of prices can no longer be suppressed. To model the effects of trade barriers it is necessary to make specific assumptions about the elasticities of supply and demand. A convenient way to do that is to use a log-linear (Cobb-Douglas) utility function and log-linear production functions.

Log-linear utility implies that the budget shares are fixed parameters:

$$p_k\ C_k\ /\ Y = \alpha_k \tag{7}$$

where C_k is consumption of commodity k, p_k is the internal (tariff inclusive) price, Y is total expenditure and α_k is the fixed expenditure share. Then using the identity that trade is the difference between production and consumption, we can solve for the trade equations as:

$$\mathbf{T} = \mathbf{A}^{-1}\ \mathbf{V}\ -\ \mathbf{P}^{-1}\ \alpha\ Y.$$

where **P** is a diagonal matrix with internal prices on the diagonal.

The level of a tariff on commodity k will be denoted by t_k and the corresponding external price by π_k. Then the internal price of the commodity is

$$p_k = \pi_k\ (\ 1 + t_k).$$

Some assumption is necessary concerning the use to which the tariff revenues are put. The most convenient assumption is that these revenues are spent as if they were ordinary income. Expressed differently, we may assume either that tariff revenues are redistributed to consumers in a way that does not distort their consumption choices or alternatively that the government has the same utility function as the "representative consumer". Then we may solve for the expenditure level of the economy by imposing the trade balance condition $B = \pi' T$:

$$Y = (\pi' A^{-1} V - B)/(\pi' P^{-1} \alpha) = (GNP - B)\ (1+t.), \tag{8}$$

where GNP is the value of output at world prices $\pi' A^{-1} V$, and t. is an index of trade barriers overall:

$$(1+t.) = (\sum \alpha_k/(1+t_k))^{-1}. \tag{9}$$

Incidentally, the summation in this expression extends over all commodities, including export items. For example, if tariffs are uniformly set to t for all import commodities, then $(1+t.) = (1+t)/(1+\alpha_x t)$ where α_x is the share of imports and exports in consumption.

Cobb-Douglas (log-linear) production functions and cost minimization imply fixed factor shares: $\theta_{fk} = w_f A_{fk}/p_k$ where θ_{fk} is a technologically fixed parameter, w is the factor return, p is the product price and A is the input-output ratio. In matrix form this becomes

$$\Theta = W\ A\ P^{-1}\ ,$$

where Θ is a matrix of technologically fixed factor shares and where notation indicating the dependence of all of the variables on time is suppressed. Substituting this into (1) yields the production relationships

$$\Theta\ P\ Q = W\ V.$$

In words, the product of the input share Θ matrix times the value of output PQ is equal to the value of the input WV.

The Stolper-Samuelson mapping of commodity prices into factor prices given this Cobb-Douglas technology can be found by substituting the cost minimization condition for selecting the amount of input f in commodity k, $V_{fk} = \theta_{fk} p_k Q_k / w_f$, into the unit value isoquants $1 = p_k Q_k$ which can be written as:

$$0 = \ln(p_k) + \ln(\alpha_k) + \sum_f \theta_{kf} \ln(V_{fk}) \ , \quad k = 1,2,\ldots,$$

After substituion this produces the system:

$$\Theta' \ln(\mathbf{w}) = \ln(\mathbf{p}) + \ln(\mathbf{k}) \qquad (10)$$

where $\ln(\mathbf{w})$ is a vector of logarithms of factor returns, $\ln(\mathbf{p})$ is a vector of logarithms of prices, and $\ln(\mathbf{k})$ is a vector of constants. Solving this system for factor returns as a function of product prices we obtain:

$$\log(w_f) = c_f + \sum \log(p_k)\ \theta^{kf} = c'_f + \sum \log(1+t_k)\ \theta^{kf} \qquad (11)$$

where θ^{kf} is the (k,f) element of the inverse of Θ and where c_f and c'_f are suitably selected constants.

Under these assumptions the trade vector satisfies

$$\mathbf{PT} = \Theta^{-1}\,\mathbf{W}\,\mathbf{V} - \alpha\,Y = \Theta^{-1}\,\mathbf{W}\,\mathbf{V} - \alpha\,\text{GNP}\,(1+t.) \qquad (12)$$

where the internal factor prices $\mathbf{W}$ are functions of the product prices according to the log-linear relationship (10). In words, the net export vector evaluated at internal prices is a function of factor supplies evaluated at internal prices and the product of GNP evaluated at external prices times an index of trade barriers.

Equations (11) and (12) fully describe the effects of tariffs in this general equilibrium model with logarithmic production functions and logarithmic utility functions. The principal effect of the tariff in the trade system (12) is to revalue the factor supplies $\mathbf{V}$ and the trade flows T. The revaluation of the factor supplies is described by the system of equations (11).

The equation for commodity k taken from the system (12) is

$$\pi_k T_{ik} = \{\sum_f [\theta^{kf} w_{if} V_{if}] - \alpha_k GNP_i(1+t_{i.})]\} / (1+ t_{ik}) \qquad (13)$$

where $\pi_k T_{ik}$ is the (f.o.b.) value of net exports of commodity k by country i, t_{ik} is the tariff barrier on commodity k in country i, V_{if} is the supply of factor f in country i, $t_{i.}$ is the tariff average of country i, θ^{kf} is a component of the inverse of the factor share matrix Θ^{-1}, α_k is the consumption share of commodity k, and w_{if} is the internal reward to factor f in country i satisfying (11). The model consisting of equations (11) and (13) presents many puzzles for a data analysis. One of the more difficult problems is that (11) involves the elements of the <u>inverse</u> of the factor input matrix θ^{kf}. Some input shares are observable, but given the large number of commodities, it is unlikely that there will be a square matrix of shares. Moreover, any attempt to include variables like the elements of an inverse of input intensities is surely taking the n-good n-factor general equilibrium model too seriously.

One "solution" is to note that we can generally write an element of the inverse of the factor share matrix as a function of the corresponding element of the matrix

$$\theta^{kf} = \beta_{kf}/\theta_{kf}$$

where β_{kf} is an unobservable with a value implied by the partitioned inverse rule. If the matrix is arranged so that kf selects a diagonal element, then

$$\theta^{kf} = \det(\Theta_{(fk)}) / \det(\Theta)$$

$$= \det(\Theta_{(fk)}) / \theta_{fk} \det(\Theta_{(fk)} - \Theta_{(k)}\Theta_{(f)}'/\theta_{fk})$$

where det() refers to a determinant, $\Theta_{(fk)}$ is the submatrix of Θ with row f and column k omitted, $\Theta_{(k)}$ is column k with element f omitted and $\Theta_{(f)}$ is column f with element k omitted. Thus

$$\beta_{kf} = \det(\Theta_{(fk)}) / \det(\Theta_{(fk)} - \Theta_{(k)}\Theta_{(f)}'/\theta_{fk})$$

which is equal to one if this factor is not used in any other industry, $\Theta_{(f)} = 0$, or if this industry uses only this factor $\Theta_{(k)} = 0$. An empirical approximation to this assumption is that

$$\beta_{kf} = 1 + \epsilon_{kf}$$

where ϵ_{kf} is a random variable with mean zero.

Another approximation is that the structure of barriers has a negligible effect on the earnings of the factors,

$$w_{if} = w_f$$

With these assumptions, (13) becomes

$$\begin{aligned} \pi_k T_{ik} &= \{\textstyle\sum_f [\ (1 + \epsilon_{kf}) w_f V_{if}/\theta_{kf}] \ - \alpha_k \ GNP_i(1+t_{i.})]\} \ / \ (1+ t_{ik}) \\ &= GNP_i\{\textstyle\sum_f [\ (1 + \epsilon_{kf}) s_{if}/\theta_{kf}] \ - \alpha_k \ (1+t_{i.})]\} \ / \ (1+ t_{ik}) \qquad (14) \end{aligned}$$

where s_{if} is the share of earnings of factor f in country i, $s_{if} = w_f V_{if}/GNP_i$.

Equation (14) is the loose justification for running a regression of the logarithm of imports on measures of trade barriers, a country scale variable (GNP_i), a commodity scale variable α_k, and interactions between country factor supplies and industry input intensities s_{if}/θ_{kf}. The first set of regressions do not use any observables but control for differences in countries and commodities with a set of dummy variables only. The second set of estimates use GNP and the interaction variables s_{if}/θ_{kf} but control for commodity scale differences with a set of dummy variables since direct measures of the consumption scale variables α_k are unobservable.

Clearly this offers only a loose justification for the cross section data analysis. A couple of untreated problems are worth mentioning:

a) This model of <u>net</u> exports does not justify treating exports and imports separately.

b) The data that are analyzed are aggregated at least to some extent. This model of <u>net exports</u> can be aggregated easily, but aggregation separately for imports and exports produces an extremely complex model that is unlikely to be amenable to a data analysis. Accordingly, the model offers little foundation for the analysis of the effects of barriers on the gross imports of commodity aggregates.

2.0 Overview of Data Set

The main features of the trade data set that is the subject of this analysis are:

- Year: 1983.
- Importers: Fourteen industrial countries including Finland, Japan, Norway, Switzerland, the USA, and the EEC countries:Belgium-Luxembourg, Denmark, France, West Germany, Greece, Ireland, Italy, Netherlands, and the United Kingdom.
- Commodity classification: 4-digit Standard Industrial Trade Classification SITC(R1) .

The variables that are included are:

- Imports
- NTB coverage ratios: four categories of import-weighted NTB coverage ratios.
- Tariffs: Import-weighted tariff averages

The data set on nontariff barriers has been compiled by UNCTAD as part of an on-going project measuring the extent of nontariff barriers to trade. The express purpose of the project is to reduce the intransparency of national trade policies and to determine the effects of these policies, especially as they relate to the trade of developing countries. Portions of the data set have been turned over to the World Bank where, presumably, they have been manipulated further. The data sources include both GATT and government publications. GATT data normally cover only those measures brought to the attention of the GATT secretariat either by countries applying them or by countries complaining of their application. 60% of the data records were culled from government publications such as those distributed to customs officers. (Source: UNCTAD TD/B/940, Annex III)

The difficulties that arise in the construction of this data base must surely be nearly overwhelming. There are substantial problems of classification of barriers that are known to exist and there are extraordinary problems of uncovering barriers. UNCTAD(1985) reports: "Clearly the compilation, updating and extension of the Data Base is a highly complex and detailed exercise, but its usefulness is highly dependent on the accuracy of the data and its correct classification. Thus, the data has been checked to the extent possible, and to this end, the UNCTAD secretariat has sought the active collaboration of Governments....These consultations have enabled the secretariat to obtain clarifications and additional information." This leaves the impression that the presence or absence of a barrier on the data base is the result of a complex negotiation between representatives of the states included in the data set and representatives of UNCTAD.

Coverage of Barriers

This data set on nontariff and tariff barriers is incomplete in several respects:

1) Only product-specific barriers are included. General barriers are excluded. Excluded are measures such as national import-substitution policies, global import targets, foreign exchange controls, state monopoly of imports, discriminatory financing charges favoring exporters over importers, tax structures, capital controls etc.

2) Domestic subsidies and export measures are excluded. States which rely less on border measures against imports and relatively more on non-border measures will appear to have relatively low trade barriers.

3) No record of tariff or nontariff barriers exists if imports are zero.

NTB Aggregation

The basic data set includes 52 different product-specific nontariff barriers ranging from wildlife prohibitions to Voluntary Export Restraint programs. These 52 different barriers have been arranged hierarchically as reported in Table 1. The main division of NTB's consists of the following four groups:

(1) Price Maintenance NTB's that attempt to control the domestic price of the imported goods.

(2) Quantitative Restrictions that limit the quantity of imports.

(3) Quality Regulations that assure that imports meet certain quality standards.

(4) Threats that suggest the possibility of future restrictions of an unspecified nature.

In principle, the health and safety regulations could be regarded to be quantitative restrictions that prohibit the importation of certain products, but this observation seems overly pedantic and the separation of health and safety regulations from quantitative restrictions turns out to be informative.

An ideal classification system for nontariff barriers would distinguish trade measures that have substantially different economic effects and would not distinguish measures that have substantially the same economic effects. Suppose, for example, that there were two types of barriers that were signaled in the data set by dummy variables NTB_1 and NTB_2. If imports as a function of the presence of the barriers could be written as $M = \alpha + \beta_1 NTB_1 + \beta_2 NTB_2$, and if these different barriers had identical effects, $\beta_1 = \beta_2$, then we can aggregate to $M = \alpha$

+ βNTB where NTB = $NTB_1 + NTB_2$.[1] Thus the separate measures NTB_1 and NTB_2 would ideally be retained only if there were a substantial difference in their effects, $\beta_1 \neq \beta_2$.

This ideal classification system seems virtually impossible to achieve in practice because of the great complexity and subtlety of the measures that are used by governments to deter trade. For example, in some countries "automatic" licences are automatically granted only if the importer is an accepted member of a domestic producer association; in other countries automatic licenses are used as part of a monitoring system or can be used, through administrative procedures, to retard imports (usually at a cost to the importer through warehousing and the opportunity cost of capital which is not at work.) It would be an extraordinary task to attempt a classification scheme for NTB's that was broad enough that it would allow one to distinguish one kind of "automatic" licensing from the other, and would also make all other similar subtle distinctions. Even if such a data base did exist, we couldn't deal econometrically with the morass of NTB variables that it would surely include. Some form of aggregation would surely be required.

An ideal NTB grouping scheme clusters barriers which have similar effects within groups and different effects between groups. Our four-part scheme is intended to have this feature but it is built entirely on simplistic theoretical ideas without reference to this data set. Ideally, this aggregation should have been driven partly by a well-

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[1] Actually, the aggregation of barriers that is applied below is based on the assumption that barriers are either non-duplicative or redundant, since the aggregation over different categories is done by NTB = $\mathrm{Max}(NTB_1, NTB_2)$. The case of redundance is expressed mathematically by the import function $M = \alpha + \beta\ \mathrm{Max}(NTB_1, NTB_2)$. The nonduplicative assumption is $\mathrm{Max}(NTB_1, NTB_2) = NTB_1 + NTB_2$.

organized theory, partly by the data. But it is probably too much to ask of the data to determine very much about the best aggregation scheme. As a matter of fact, it is even difficult to obtain credible estimates of the different effects of our four different categories of measures.

Concordance Problems

Parenthetically, it needs to be understood that there are great problems in putting together this data set because of the number of different commodity classification schemes, five in total: CCCN-based systems, TSUS, SITC(R1), SITC(R2), and SIC. The raw non-USA data is presented in CCCN-based classifications. The raw USA data is in TSUS form. Suffice it to say that this causes extraordinary difficulties; a full account will be provided on request.

3.0 Preliminary Data Analysis

The presence or absence of a nontariff barrier is signalled in the data set by a variable NTB_{ijkn} taking on the value one if a nontariff barrier of type n is applied against the imports of commodity k by importer i from exporter j. These NTB indicators are aggregated to form NTB coverage ratios applicable to importer group I, exporter group J, commodity group K and NTB group N:

$$NTB_{IJKN} = \sum_{i\in I, j\in J, k\in K} w_{ijk} \; NTB_{ijkN}$$

$$NTB_{ijkN} = \underset{n\in N}{Max}(NTB_{ijkn})$$

$$w_{ijk} \geq 0 \; ,$$

$$\sum_{i\in I, j\in J, k\in K} w_{ijk} = 1$$

The indicator NTB_{ijkN} takes on a value of one if there is an NTB in group N imposed by importer i against the exports of J of commodity K. If the weights are proportional to the level of imports, then these coverage ratios are equal to the percentage of a commodity class covered by an NTB of type N. Note that if NTB group N is disaggregated into subclasses A and B, then the indicator for the aggregate is generally less than the sum of the indicators for the components, $NTB_{IJKN} \leq NTB_{IJKA} + NTB_{IJKB}$, with equality if and only if no import item is subjected to both an NTB of type A and an NTB of type B.

An ideal but unavailable set of weights in these averages would be the level of imports that would have occurred in the absence of barriers. Three alternative sets of weights are commonly used instead of these ideal weights (e.g. Nogues et. al.,1986): home imports, world imports and equal weights. Each of these sets of weights is likely to depart substantially from the ideal. Weighting by home imports understates the ideal coverage ratios if barriers are effective in reducing imports. For example, a country that had strict prohibitions against a subset of commodities and no barriers otherwise would have a zero coverage ratio if own imports are used as weights.

Coverage ratios weighted by total world imports can also suffer from downward bias especially if the commodity structure of barriers is similar in most countries since then the world weights are inappropriately low whenever barriers are severe. However, variability of barriers across importers will make the world weighted coverage ratios less subject to this kind of downward bias. On the other hand, world weighted averages do not take any account of the special features of importers that make them relatively dependent on particular products. To put this differently, the world weighted averages ignore the component of variability in the ideal averages that is due to the ideal variability of weights across countries.

Unweighted averages of NTB indicators seem likely to be even worse approximations to the ideal averages since barriers against commodities with negligible trade are treated the same as barriers against the imports of major commodities. In addition, like world-weighted averages, unweighted averages ignore differences in countries that would cause differences in their free-trade import levels.

Own-import weighted NTB coverage ratios for each of the fourteen importers, for the EEC countries and for the fourteen importers as a group are presented in the first column of numbers in Table 2. Switzerland has the most frequent NTB's with forty-seven per cent of imports affected. Japan is second with a 38 per cent coverage ratio. The countries with the lowest NTB coverage ratios are members of the European Economic Community. According to our data set, there are no barriers on intra-EEC trade, and consequently the coverage ratios for the EEC countries are relatively low. These coverage ratios for the EEC members contrast with the relatively high number of twenty seven per cent for the EEC as a whole, this higher figure referring only to external EEC trade.

Columns two to five of Table 2 contain the figures for the disaggregated NTB coverage ratios: price maintenance NTB's, quantity restrictions, health and safety regulations, and threats. Coverage ratios that are "unusual" are indicated in boldface. These "unusual" ratios are those numbers that are both the largest for the importing country and also exceed the coverage ratio for the fourteen importers overall.

By this definition, the Swiss have unusually frequent health and safety regulations and threats. The Japanese have unusually frequent health and safety regulations. The EEC has unusually frequent price maintenance NTB's and quotas. France has frequent quotas. The USA has no unusually frequent NTB's since all of its ratios are smaller than the averages for the fourteen importers overall..

The coverage ratios of each of the four types of NTB's are displayed in Figure 1. Many of the facts that are apparent in the table stand out even more in these figures. Health and Safety Regulations, which for the fourteen importers are not unusually frequent, are very frequently applied to the imports of Japan, Finland and Switzerland. Threats are also a frequent barrier of Switzerland, but are not used at all by the Japanese. Quantity restrictions are applied frequently by France, but infrequently by Switzerland and by Finland. Price maintenance NTB's are infrequently used by Japan and Norway.

The last column of Table 2 contains "tariff coverage ratios" which indicate the percentage of imports to which a tariff is applied. Adjacent to this column are the corresponding tariff averages. The tariffs and tariff coverage ratios are displayed in Figures 2a and 2b with importers ordered by overall NTB ratio, as in Figure 1. If countries with high NTB coverage ratios had also high tariff coverage ratios and high tariffs, then Figures 2a and 2b would look like Figure 1, with the relatively long bars on the left of the figure. Figure 2a does have some similarities with Figure 1, but the USA and Norway are clear outliers with unusually frequent tariffs. Belgium/Luxembourg is an exception going the other way: relatively infrequent tariffs. The tendency of the numbers to decline as the eye moves to the right is less evident in Figure 2b, which displays the tariff averages. Thus, although there is some tendency for countries with frequent nontariff barriers also to have frequent nontariff barriers, there is less of a relationship between nontariff barriers and tariff averages.

Tables 4 and 5 contain coverage ratios applicable to the ten commodity groups constructed by Leamer(1984) on the basis of similarity of net export patterns. The full description of these aggregates in terms of the two-digit SITC codes is reported in Table 3. The first two of these aggregates (PETRO and MAT) are raw materials. The next four (FOR, TROP, ANL, CER) are crops and the last four (LAB, CAP, MACH, CHEM) are manufactures. ALL refers to all commodities. These commodity aggregates are roughly arranged to suggest a ladder of development with the least developed countries concentrating exports on the first products (raw materials) and the most developed concentrating exports on the last (chemicals).

To facilitate the reading of Table 4, coverage ratios in excess of the overall (ALL) average are printed in boldface. This identifies for each importer or importer-collective the products that are most frequently subjected to a nontariff barrier. For the fourteen importers overall, it is the crops and raw materials that are subject to especially frequent barriers. Most of the other unusually large numbers are also the coverage ratios applicable to crops.

Departures from the typical pattern of protection are the unusually high coverage ratios applicable to commodities that are not unusually protected by the fourteen importers overall. For example, petroleum overall is relatively unprotected with a coverage ratio of 13 per cent, but Switzerland, Finland, Netherlands, Norway and Belgium and Luxembourg have unusually frequent barriers applied to Petroleum products. Some other "outliers" are the frequent barriers against chemicals by the Swiss, the Japanese and the Norwegians, and the frequent barriers against the Labor intensive manufactures by the US and several of the EEC countries.

Table 5 contains the disaggregated coverage ratios, tariffs and tariff coverage ratios for the fourteen importers overall. Here the commodities are ordered by the overall NTB coverage ratio. As in Table 2, numbers are printed in boldface that both one of the largest numbers applicable to the commodity and is also larger than the overall averages. This table indicates that the crops are frequently subjected to price maintenance NTB's and to health and safety regulations. Quotas apply to the Labor- and Capital intensive manufactures. Threats apply to the Labor-intensive manufactures.

The commodity profiles of the NTB coverage ratios are graphed in Figure 3. Quantitative restrictions seem to be fairly uniformly distributed over these commodity classes, but somewhat infrequent on Forest products, which are subject to relatively frequent threats. Price maintenance NTB's and health and safety regulations are concentrated on the crops. Threats are especially frequent against Forest products, Labor- and Capital-intensive manufactures.

Figure 4 displays the data on tariff averages and tariff coverage ratios applied to each of the commodity groups by the fourteen importers. The tariff coverage ratios are typically higher than the NTB coverage ratios, but the tariff averages are generally rather low. Tariffs are relatively high against the Labor- and Capital-intensive manufactures, and against Tropical agricultural products.

4.0 Estimates of the Effects of Barriers on Imports

The first set of regressions control for differences in importer and commodity with a set of dummy variables. In the model reported subsequently, differences in importer and commodity are explained by a set of variables such as resource supplies for countries and capital/labor ratios for commodities. The model with explicit variables imposes the restrictions that the country and commodity effects are linear combinations of certain observed variables. If these restrictions are correct, the estimates of the effects of trade barriers will be more efficient, but if the restrictions are incorrect, the estimates will be biased and inconsistent. If the data set were large enough in both the commodity and country dimensions, the coefficients on the dummy variables could be estimated accurately, and any restrictions on their values would be unnecessary and probably unwise. But in samples with the number of importers limited to fourteen, the sample size is unlikely to be large enough to support the dummy variable model. To express this differently, after controlling for commodity and importer with dummy variables, there may remain very little variation in the variables measuring the barriers, and therefore detecting the effect of the remaining small variation may be impossible. The dummy variable model is nonetheless of interest since the estimated effects of trade barriers, though noisy, are nonetheless unbiased.

Formally, the dummy variable models take the general form:

$$\log(M_{ik}) = \alpha_i + \alpha_k + (\beta_i + \beta_k)\ NTB_{ik} + (\gamma_i + \gamma_k)\ TAR_{ik} + \beta''\ NTB_{i''k} + \gamma''\ TAR_{i''k} + \epsilon_{ik} \qquad (15)$$

i = importer

i"= importers other than i

k = commodity

M = Imports in thousands of U.S. dollars

NTB = coverage ratio of nontariff barriers,(0.0 - 1.0)

TAR = import-weighted tariff average.(Per Cent, 0-100)

This model allows for both nontariff and tariff barriers to deter trade with effects that vary by importerr and commodity. It allows trade to be diverted from other importers(i") if they have relatively high barriers.

This model can be estimated subject to a number of simplifying assumptions listed in Table 6. Model nine is the general unrestricted model. The other models impose one or more restrictions on this general model. The most restrictive model is the first which has the importer, exporter and commodity dummies, and the direct NTB effect with a constant coefficient. The second model allows for tariffs as well as NTB's to affect imports. The third and fourth models allow trade diversion through the NTB variable. The fifth includes the tariff effect; the sixth and seventh allow for a variable effect of NTB by importer, exporter and commodity. The eighth includes the diversion variables as well.

The results based on these models are reported in Tables 7 to 11. The full model does better than the smaller models in terms of the adjusted R^2 reported in table 8, although the differences are not dramatic. Table 7 contains the estimated effect of the trade barriers. This log linear model takes the form $M = \alpha \exp(\beta x)$ where x may refer to a tariff average or an NTB coverage ratio. The ratio of imports at x to imports at x = 0 is $\alpha \exp(\beta x) / \alpha \exp(\beta\, 0) = \exp(\beta x)$. The values of

$\exp(\beta x)$ for the NTB coverage ratios, and the tariff averages are reported in Table 7.

When the NTB and tariff effects vary with commodity and importer, the number reported in Table 7 is based on a simple average of the estimated values of β. It would be better to use an import-weighted average since an import-weighted average is an approximate answer to the question: by how much would imports change if NTB coverage ratios increased from zero to one-hundred per cent. Generally, the percentage change in imports can be expressed using the linear approximation $\Delta \log(M_{ik}) = (\beta_i + \beta_k)\ \Delta\ NTB_{ik}$ as

$$\Delta M/M = \sum M_{ik}\ \Delta \log(M_{ik}) / \sum M_{ik} = \sum M_{ik}\ (\beta_i + \beta_k)\ \Delta\ NTB_{ik} / \sum M_{ik}. \qquad (16)$$

The special case, $\Delta\ NTB_{ijk} = 1$ implies the import-weighted average:

$$\Delta M/M = \sum_{ik} M_{ik}\ (\beta_i + \beta_k)\ / \sum_{ik} M_{ik}$$

(The analogous formula for the case in which the coefficient does not vary uses the linear approximation: $\exp(\beta x) - 1 \approx \beta x$, which is applicable for small values of βx.) These import-weighted averages are used below for studying several counterfactuals.

The NTB effects in Table 7 for the first five models do have the right sign as does the tariff. Depending on whether the model controls for NTB's of other importers, the estimated effect of increasing the coverage ratio from zero to one hundred per cent is to reduce imports to either eighty per cent or fifty five per cent of the original value. When these effects are allowed to differ by importer and commodity, the results are mixed, but the average has the "wrong" sign.

The trade diversion effect should be positive, meaning that an increase of barriers by some country will divert trade elsewhere. The trade diversion effects are the wrong sign for the small models but do take on the right sign for models 8 and 9 in three of four cases. These estimated effects seem very substantial, however.

The t- and F-values for these coefficients are reported in Table 8. The nontariff barriers generally are statistically significant (the effects are measureable), and the tariff effects generally are not.

The overall averages of the effects of barriers reported in Table 7 can be broken down by importer using the formula (16) indicating the effect of a hypothetical change in the levels of the barriers. The effects of different counterfactuals are reported in Table 9, 10, and 11. The counterfactuals considered are:

1) By how much would imports of country i decrease if its coverage ratio applicable to all exporters and all commodities increased from zero to one-hundred per cent ($\Delta\ NTB_{ik} = 1$):

2) By how much would imports of country i decrease if its coverage ratios increased from zero to the observed value NTB_{ijk} ($\Delta\ NTB_{ijk} =$ $\gamma\phi\sigma\sigma\epsilon\xi\upsilon\ \chi\alpha\mu\phi\epsilon\ o\varsigma$ NTB_{ijk}):

Parenthetically, note that the counterfactual of raising barriers to their current level and the counterfactual of raising barriers to one-hundred per cent are related by the formula:

$$\sum M_{ik}\ (\beta_i + \beta_k)\ NTB_{ik} / \sum M_{ik} =$$

$$[\sum M_{ik}\ (\beta_i + \beta_k)\ NTB_{ik} / \sum M_{ik}\ (\beta_i + \beta_k)] \times [\ \sum M_{ik}\ (\beta_i + \beta_k)\ /\ \sum M_{ik}\ ]$$

$$= \text{NTB average} \times \text{Average elasticity}$$

In words, the per centage reduction in imports associated with raising barriers to their current level is equal to an NTB average times an average elasticity. The average elasticity is the answer to the counterfactual: by how much would imports decrease if barriers were raised from zero to one hundred per cent. The NTB average is weighted by the product of the level of imports and the elasticity.

Estimates of the importer counterfactuals for NTB's and tariffs are reported in Tables 9, 10 and 11. These are based on Bayesian estimates of the model that shrink the estimated coefficients to a common value. The relatively complex model with the effects of barriers varying with importer and commodity produces many "wrong" signs. The models that do produce "good" results are the simpler models which do not allow the coefficients to vary with importer and commodity, but these models do not yield answers to the interesting questions concerning the importers and commodities that are most affected by nontariff barriers. The solution to this problem is to allow the coefficients some freedom to vary by commodity and importer, but not as much freedom as the ordinary least squares regression with the full model. This can be accomplished by supplementing the data set with a fictitious data set that encapsulates the notion that the coefficients are not very different. This is a Bayesian method with a prior distribution that suggests that the coefficients do not vary much, and that consequently shrinks the importer and commodity effects to a common value. Details are available on request.

The second column of Table 9 is the estimated effect of trade barriers on the imports of each of the fourteen importing countries. The table is ordered by this column. The first column is the overall NTB coverage ratio. Absent information about the relative impact of NTB's applied by different importers against different commodities, the restrictiveness of the barriers would be indicated by this first column. The "news" in the statistical procedure is the discrepancy between these two columns, which is pretty clearly signaled by an odd elasticity in column (4). In particular, although Japan has relatively frequent nontariff barriers, the estimated effect of these barriers is actually to increase trade because the estimated elasticity in column (4) is positive. It would be possible to tighten the prior distribution to eliminate this anomalous sign, but in tightening the prior the relative ordering of countries is unlikely to change much.

It is worth pausing briefly to consider the feature of the data set that would lead to the conclusion that the Japanese barriers are relatively ineffective. The model includes both commodity dummy variables and importer dummy variables. One can think of the process of estimation in two steps: first the effects of the importer and commodity dummies are removed; then the NTB effect is estimated from the remaining variability. Thus the conclusion that the Japanese barriers are relatively inconsequential is due to the fact that for those commodities against which the Japanese have unusually frequent barriers, the Japanese do not have unusually low imports, in fact the opposite is true. One possibility is that the Japanese have unusually frequent barriers against many of the crops, but the Japanese level of imports of these crops is not unusual compared with the other fourteen importers. The important point is that the comparison is strictly with the other importers, and no adjustment is made for the fact that the Japaneses, because of absence of farmland, would in the absence of barrier be much more dependent on imports of crops than the other importers. Another way to say this is that the model has the feature that in the absence of barriers, all countries are predicted to have the same commodity composition of imports. This doubtful assumption is remedied with the next set of models that include variables like farmland that allow for differences in the pattern of barrier-free trade.

For most of the countries, the estimated effect of the NTB's in Table 9 is not substantial, mostly less than two per cent of imports. For France the effect is six per cent, for Switzerland ten per cent and for Finland fourteen per cent. The large estimate for Finland is partly due to the frequent barriers, but also due to the large elasticity.

The effects of tariffs that are reported in Table 10 are the same order of magnitude as the effects of nontariff barriers, attaining a maximum trade-suppressing effect for Norway of six per cent of imports. Again the "news" in this table is the discrepancy in ordering of columns (1) and (2), column (1) indicating the import-weighted tariff average ratio and column (2) indicating the predicted effect of the tariffs on imports. Norway has the highest average tariffs and also the highest predicted trade effect. Finland has relatively high tariffs but the lowest trade effect (the wrong sign, in fact.) As I have mentioned above, the anomaly of a wrong sign could be eliminated by shrinking the coefficients more dramatically to a common value, but further shrinkage may not greatly alter the ordering of importers. One thing that is of interest is that it is mostly the EEC countries that have the high elasticities in column (4). This may seem a little surprising but remember that the EEC tariff is the average of the extra-EEC rate and a zero internal rate. Thus in order to have a selected level of the average tariff the external tariff must be very high and it is not inconceivable that it would have a greater "bite" than the same average rate applied by another country.

The combined effect of tariff and nontariff barriers is reported in Table 11 which is sorted by size of the combined effect. Norway and Switzerland at the top of the list are both estimated to have barriers that reduce trade by eleven per cent. Then come Finland and France. The United States is next with a total effect of barriers equal to five percent of imports. Japan is the anomaly with a positive total effect, a consequence of the estimated NTB effect. I repeat again that this anomaly could be eliminated by further shrinkage of the estimates, which is not done for two reasons. First further shrinkage may not alter greatly the ordering of countries. Secondly, by retaining the anomaly, we are reminded of the somewhat arbitrary nature of the estimates. Another way to express this is that standard errors for these numbers would have to be rather large.

Models with Country Structure

These initial regressions impose no special structure on the commodity and importer effects and, because of the number of degrees of freedom that are consumed estimating these dummy coefficients, the remaining evidence about the NTB effects may be slight. In this section a model is presented that imposes some structure on the importer dummy variables by substitution in their place some variables that measure characteristics of countries and commodities. The form of the model that is used only slightly reduces the number of parameters devoted to estimating the importer effects. It would also be desirable to impose some further structure on the commodity effects but the appropriate variables are not available.

Another important difference in this model is that the predicted commodity composition of imports, absent trade barriers, is not the same for all countries. For example, countries with relatively little land are allowed by the model to have relatively heavy imports of the land-intensive products.

The model is:

$$\log(M_{ik}) = \alpha_{1k} + \alpha_2 \log(S_i) + \eta_{ik} + \beta_{ik}\,NTB_{ik} + \beta''\,NTB_{i''k}$$

$$+ \quad \gamma_{ik}\,TAR_{ik} \quad + \quad \gamma''\,TAR_{i''jk} \quad + \epsilon_{ijk} \qquad (17)$$

where

$$\eta_{ik} = \textstyle\sum_f (\delta_{1f}\,X_{fi} + \delta_{2f} X_{fi}\,Z_{fk}\,)$$

$$\beta_{ik} = \beta_0 + \beta_1{}^t X_i + \beta_2{}^t Z_k$$

$$\gamma_{ik} = \gamma_0 + \gamma_1{}^t X_i + \gamma_2{}^t Z_k$$

and

S_i = a measure of the economic size of the country: GNP

X_i = characteristics of the country
(Population/GNP , Arable Land/GNP))

Z_k = corresponding characteristics of the commodity
(capital per man hour , land per man hour)

A full description of the sources and methods is available on request.

The difference between this model and the dummy variable model (15) is that in place of the importer and exporter dummies we have here

$$\alpha_2 \log(S_i) + \eta_{ik}$$

This model controls for differences in the scale of trade across countries with a variable measuring the size of the Gross National Product. The ideal variable in this equation would be "potential" GNP: the level of GNP in the absence of trade barriers. This model takes actual GNP of the fourteen importers as given and ignores whatever effects the trade barriers may have on GNP. But if the barriers lower GNP of the fourteen importers in the sample by approximately the same percentage, the measured value of the logarithm of GNP will be proportional to the logarithm of "potential" GNP, and the use of actual rather than potential GNP increases the GNP coefficient but leaves unchanged the estimated effects of the barriers. Still, for doing a policy analysis, it may be necessary to allow for the effect of barriers on actual GNP.

Differences in the economic importance of the different commodity classes could be measured in a way analogous to "potential" GNP by a variable like "potential" worldwide production of the commodity. Neither this variable nor its counterpart, actual production, are available. One variable that is available is total imports of the commodity by the fourteen importers. But the use of total imports seems to be a disguised way of estimating a model with commodity dummy variables and, if so, the loss of degrees of freedom in estimating these dummy coefficients is improperly ignored. Accordingly, we will retain the commodity dummies. Whether total imports or commodity dummies are used in the equation, the effect of barriers on the worldwide composition of trade is ignored just as the effects of the barriers on GNP are ignored. Though it seems possible to argue that the effect on GNP takes a form that leaves the estimated equation relatively unaffected, a similar argument cannot be made in the case of the commodity structure of trade. The commodity structure of trade barriers of these fourteen countries has a substantial degree of similarity that is likely to depress relatively the trade in some commodities more than others. There doesn't seem to be much that can be done about this unless we had a variable that came close to measuring the barrier-free level of world-wide production

The effects η_{ik} account for the comparative advantage of the importer and exporter. After controlling for country and commodity size, there are interactions between country and commodity characteristics that make a country more or less dependent on imports/exports of particular commodities. A country that is abundant in land is less likely to have great amounts of agricultural imports; a country that is very abundant in capital compared with labor is likely not to import capital intensive products. This coupling of country and commodity characteristics can be justified only in an ad hoc fashion as we have discussed in Section 1.

The application reported below has two factors, f = 2. The first factor is labor and the second is land. The effect η_{ik} then refers to four variables: (Population$_i$/GNP$_i$, Arable Land/GNP$_i$, (Population$_i$/GNP$_i$ × capital per man in industry k , Arable Land/GNP$_i$ × land per man in industry k)). Note that the country characteristics are allowed to enter individually, but the commodity characteristics cannot because of the commodity dummy variables which are necessarily perfectly collinear with the commodity characteristics.

Eight different varieties of this model are estimated differing in the whether the trade diversion variables are included and whether the trade barrier variables differ by country and commodity characteristics. These eight varieties are listed in Table 12.

The adjusted R^2's for these eight models are listed in Table 14 together with the t-values of the effects of the trade barriers. There is not a great deal of variability in these measures of fit, but they slightly favor the larger models.

The estimates of the effects of barriers, reported in Table 13, generally have the expected sign. The tariff effects are much greater than the NTB effects, in fact in this case the tariff effects are enormous. Though the direct barriers have the expected sign, the diversion variables do not.

The t-values for the comparative advantage part of the model are reported in Tables 15. The country size variables, not surprisingly, are highly significant. Next is the land abundance variable, which has a trade-suppressing effect. The labor abundance variable contributes positively to imports, though the effect is not as statistically significant(i.e. measureable) as the land variable.

The interactive effects reported in Table 15 for the importer variable take on the correct signs: Land abundance reduces imports of commodities that use a lot of land; labor abundance increases imports of commodities that are capital intensive. The land interaction is the more statistically significant effect.

To conclude, then, the model which accounts for differences in comparative advantage in terms of measureable characteristics of commodities and countries does a fairly good job of explaining the structure of trade, but leaves the impression that the NTB effects are difficult to detect, whereas the effects of tariffs are more clear and more substantial.

Models with Disaggregated NTB Variables

To this point, all the models have made use of the overall NTB coverage ratio. This overall ratio is now disaggregated into price NTB's, quotas, quality controls and threats. The versions of model (15) and (17) that are considered are:

MODEL A

$$\log(M_{ik}) = \alpha_i + \alpha_k$$
$$+ \beta_p PRICE_{ik} + \beta_q QUOTA_{ik} + \beta_c CONTR_{ik} + \beta_c THREAT_{ik} + \gamma\ TAR_{ik}$$
$$+ \beta''\ NTB_{i''k} + + \gamma''\ TAR_{i''k} + \epsilon_{ik}$$

MODEL B

$$\log(M_{ik}) = \alpha_{ik} + \alpha_2 \log(S_i) + \alpha_3 \log(S) + \eta_{ik}$$
$$+ \beta_p PRICE_{ik} + \beta_q QUOTA_{ik} + \beta_c CONTR_{ik} + \beta_c THREAT_{ik} + \gamma\ TAR_{ik}$$
$$+ \beta''\ NTB_{i''k} + \gamma'' TAR_{i''k} + \epsilon_{ik}$$

where:

PRICE = coverage ratio of price NTB's

QUOTA = coverage ratio of quotas

CONTR = coverage ratio of quality controls

THREAT = coverage ratio of threats

Note that the dependence of the trade barrier coefficients on importer and commodity have been eliminated in order to focus on the disaggregation of the NTB variable. For the same reason, the models do not include disaggregated trade diversion variables. Only two cases of these models will be considerd, the first without the diversion variables ($0 = \beta'' = \gamma''$) and the second with the diversion variables. These are comparable with cases 2 and 4 considered earlier and these numbers will be retained for easy reference: case 2 without the trade diversion variables, and case 4 with.

Estimates and t-values, and adjusted R^2's are reported in Tables 17 and 18. The adjusted R^2's in Table 17 for the more complete models (A2, B2) with the trade diversion variables included are slightly higher than for the smaller models. The dummy variable model A does better than the comparative advantage model B. The adjusted R^2 for model A4 in Table 17 slightly less than the adjusted R^2 for model 4 reported in Table 8, suggesting that disaggregation of the NTB variables isn't helpful in the model with the trade diversion variables.

The estimates of the effects of barriers reported in Table 16 are equal to the predicted value of trade with the barriers divided by the predicted value without the barrier, $\exp(\beta)$, and would be less than one if the barriers were estimated to suppress trade. The difference between models two and four is that model two excludes the diversion variables. Exclusion of the diversion variables makes it difficult to measure the effect of quantitative restrictions (QUANT) (small b and small t-value), but the other NTB variables are "statistically significant." These estimates compare with the estimates for the aggregate model 2 reported in Table 7 of .815 for NTB's and .635 for tariffs. The estimates of the tariff effect in Table 16 is larger, as are all but the QUOTA variable for NTB's. In order of magnitude of the predicted effect of barriers, the estimates for model A4 are: threats, quality controls, price maintenance NTB's and quantitative restrictions. For the other models, threats do not have as big an impact. Quality controls seem often to have one of the largest effects, but the relative ordering varies quite a bit from model to model.

To conclude, disaggregation of the NTB variable does not dramatically improve the quality of the estimated models, but it does allow for different estimates of the effects of different types of barriers. The relative ordering of the impact of the four different types of NTB's is not easy to determine confidently from this data set, partly because the estimates vary considerably among models that seem otherwise indistinguishable. Generally though, it is the quality controls that are estimated to have the greatest effect. This reverses the conclusion that the Japanese barriers are ineffective, since they tend to use quality controls most extensively.

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Table 1

Classification of Nontariff Barriers

<u>A. PRICE-ORIENTED POLICIES</u>

TARIFFS	ad valorem	seasonal 100.11	
		charges on declared value 101.1	
	non-ad valorem	specific	two-part tariff 100.02
			seasonal tariff 100.12
			charges on declared value 101.2
			(product-) specific taxes 112
		combined	ad valorem tariff w specific minimum 100.2
			seasonal tariff 100.14
		other	ad valorem tariff w quota 100.01
			non-ad val from tariff file
	unspecified	supplementary tariff 100.3	
		two-part tariff 100.0	
		seasonal tariff 100.1	
DUTIES AND DOMESTIC PRICE MAINTENANCE	variable duties	variable levy 102.11	
		variable component 102.12	
	fair price duties	countervailing duties 102.21	
		anti-dumping duties 102.22	
	minimum pricing	minimum pricing 401, 402, 403	
		VER, price 405	
	CAP	Common Agricultural Policy 595	

B. QUANTITY-ORIENTED POLICIES

PROHIBITIONS	total	prohibition 201.1; hlth & sfty 201.2; wildlife 201.3; seasonal 201.5; indirect imports 201.7
	conditional	on basis of origin 202.2; state monop. of imp. 202.31
QUOTAS	ver	VERs 215
	textile	quota/regime 216, 217 MFA quota/consultation 590, 590.10, 590.13
	other quotas	quota 211; global quota 212; quotas by country 213; seasonal 214

C. QUALITY-ORIENTED POLICIES

quality control	health & safety	prohibition 201.2; imp auth depend on cert 301.1; technical requirements 501
	technical standards	imp auth depend on cert 301.2; technical requirements 502
	marketing, packing requirements	technical requirements 503
other	import auth.	(non-automatic authorizations to control entry) discretionary: import auth. 300.01; discretionary license 300.02; license 300.03; declaration with visa 300.04; imp auth restr, slct purchasers 300.05; import permit 300.06; conditional: auth dep on purchse of dom prod 300.13 (non-automatic authorizations to control standards) health & safety 301.1; tech. standards 301.2;

D. THREATS

THREATS	price monitoring	investigations	anti-dumping 41, 411 countervailing 41, 412
		surveillance 421	
	quantity monitoring	(automatic authorizations) 311 license for surveillance 312 liberal licensing 313 automatic licensing 314 declaration without visa 315 intra-community surveillance 317 monitoring	

Notes:
1) The numbers correspond to the UNCTAD classification scheme.
2) Each UNCTAD category maps into only one of our categories. There are three minor exceptions: 201.2, 301.1, and 301.2 each feed into two of our categories.

Table 2

NTB Coverage Ratios
By Importing Country
Weighted by Own Imports
(.) indicates less than .5%

Importer	All NTBs	Price	Quotas	Health	Threats	Tariff	Tariff CR
Switzerland	47	13	3	**22**	**21**	3	85
Japan	38	3	11	**31**	.	3	67
Finland	35	6	1	**28**	3	5	49
EEC	27	**12**	**13**	4	7	4	49
France	26	5	**18**	2	5	2	23
14 Importers	18	5	7	6	3	3	46
Netherlands	17	**8**	3	3	**7**	2	21
Norway	15	.	**9**	**7**	.	5	63
USA	13	5	6	.	3	4	79
Belgium & Lux	12	4	2	6	**7**	1	14
Denmark	11	**8**	4	.	2	3	34
Great Britain	11	**7**	4	2	3	3	30
West Germany	10	**6**	5	1	2	3	29
Italy	8	5	4	2	2	2	20
Greece	7	4	5	1	1	1	16
Ireland	5	3	2	.	1	2	23

Note: "Unusually high" coverage ratios in boldface. See text.

Table 3

Commodity Aggregates
Source: Leamer(1984)

SITC	Description
	1 PETRO: Petroleum
33	Petroleum, petroleum products
	2. MAT: Raw Materials
27	Crude fertilizers, crude materials
28	Metalliferous ores, metal scrap
32	Coal, coke, briquettes
34	Gas, natural and manufactured
	3. FOR: Forest Products
24	Wood, lumber, cork
25	Pulp, waste paper
63	Wood, cork manufactures
64	Paper, paperboard
	4. TROP: Tropical Agricultural Products
5	Fruit, vegetables
6	Sugar, sugar preparations, honey
7	Coffee, tea, cocoa, spices, etc.
11	Beverages
23	Crude rubber
	5. ANL: Animal Products
0	Live Animals
1	Meat, meat preparations
2	Dairy products, eggs
3	Fish, fish preparations
21	Hides, skins, furskins, undressed
29	Crude animal, vegetable minerals
43	Animal, vegetable oils, processed
94	Animal, not elsewhere specified
	6. CER: Cereals etc.
4	Cereals, cereal preparations
8	Feeding stuff for animals
9	Miscellaneous food preparations
12	Tobacco, tobacco manufactures
22	Oil seeds, oil nuts,oil kernels
26	Textile fibers
41	Animal oils, fats
42	Fixed vegetable oils

7. LAB: Labor intensive manufactures

66	Nonmetallic mineral manufactures
82	Furniture
83	Travel goods, handbags, etc.
84	Clothing
85	Footwear
89	Miscellaneous manufactured articles, n.e.s.
91	Postal packages not classified according to kind
93	Special transactions not classified according to kind
96	Coin nongold, noncurrent

8. CAP: Capital Intensive Manufactures

61	Leather, dressed furskins
62	Rubber manufactures, n.e.s.
65	Textile yarn, fabrics, etc.
67	Iron and steel
69	Manufactures of metal
81	Sanitary, fixtures, fittings

9. MACH: Machinery

71	Machinery, other than electrical
72	Electrical machinery
73	Transport equipment
86	Professional goods, instruments, watches
95	Firearms, ammunition

10. CHEM: Chemicals

51	Chemical elements, compounds
52	Mineral tar and crude chem. from coal, petroleum, natural gas
53	Dying, tanning, coloring materials
55	Essential oils, perfume materials
56	Fertilizers, manufactured
57	Explosives, pyrotechnic products
58	Plastic materials, cellulose, etc.
59	Chemical materials, n.e.s.

Table 4

NTB Coverage Ratios
Applicable to Ten Commodity Groups
Weighted by Own Imports
(.) indicates less than .5%

	ALL	PETRO	MAT	FOR	TROP	ANL	CER	LAB	CAP	MACH	CHEM	MISC
Switzerland	47	**98**	6	5	**75**	**94**	**65**	26	12	46	**72**	.
Japan	38	3	**57**	**52**	**99**	**99**	**80**	18	28	19	**98**	.
Finland	35	**97**	31	3	**41**	**43**	25	**45**	31	.	8	**99**
EEC	27	24	9	17	**60**	**77**	**81**	**40**	**36**	14	6	4
France	26	**71**	19	18	**40**	26	**40**	12	10	9	4	**54**
14 Importers	18	13	**19**	**20**	**37**	**36**	**51**	14	15	13	15	4
Netherlands	17	**24**	8	10	**46**	17	**58**	13	5	4	1	7
Norway	15	**21**	.	.	**98**	**77**	**78**	**32**	2	.	**21**	.
USA	13	.	1	**27**	**18**	**23**	1	3	**27**	**21**	7	.
Belgium & Lux	12	**15**	1	6	**21**	**14**	**40**	**25**	6	5	1	6
Denmark	11	.	.	**15**	**27**	**38**	**53**	**12**	**12**	5	.	6
Great Britain	11	.	1	11	**41**	**34**	**43**	**20**	10	5	1	3
W.Germany	10	.	3	10	**26**	**19**	**49**	**20**	**14**	4	1	3
Italy	8	.	1	**11**	**21**	**18**	**38**	**16**	**19**	4	4	4
Greece	7	.	2	**16**	**13**	**16**	**23**	7	**11**	**9**	.	**17**
Ireland	5	.	.	**12**	**18**	**14**	**20**	2	5	3	1	**9**

Coverage ratios in excess of the ALL average printed in **bold**

Table 5

NTB Coverage Ratios and Tariff Measures
Applicable to Ten Commodity Groups
Weighted by Own Imports
(.) indicates less than .5%

IMP (%)	Product	All NTBs	Price	Quotas	Health	Threats	Tariff	Tariff C.R.
4.3	CEREALS, ETC.	51	**33**	6	**28**	1	2	15
4.5	TROPICAL AGRIC.	37	**27**	8	**14**	2	6	51
4.4	ANIMAL PRODUCTS	36	**17**	6	**23**	4	3	31
4.0	FOREST PRODUCTS	20	5	1	7	**9**	2	30
8.6	RAW MATERIALS	19	.	7	**11**	2	1	22
100.0	ALL	18	5	7	6	3	3	46
7.6	CAPITAL INTENSIVE	15	**6**	**9**	2	7	4	53
7.3	CHEMICALS	15	3	3	**10**	1	3	37
10.6	LABOR INTENSIVE	14	1	**9**	3	**8**	7	59
20.4	PETROLEUM	13	1	**7**	1	**4**	1	50
26.0	MACHINERY	13	3	7	2	1	3	59
2.2	MISCELLANEOUS	4	3	3	.	3	.	2

Note: "Unusually high" coverage ratios in boldface. See text.

Table 6

Models With Importer and Commodity Dummy Variables

$$\log(M_{ik}) = (\alpha_i + \alpha_k) + (\beta_i + \beta_k)\ NTB_{ik} + (\gamma_i + \gamma_k)\ TAR_{ik} + \beta''\ NTB_{i''k} + \gamma''\ TAR_{i''k}$$

	(α_i	α_k)	(β_i	β_k)	(γ_i	γ_k)	(β'')	(γ'')
1	*	*	c					
2	*	*	c		c			
3	*	*	c				*	
4	*	*	c		c		*	*
5	*	*	*	*				
6	*	*	*	*	c			
7	*	*	*	*	c		*	*
8	*	*	*	*	*	*	*	*

Cases: * = included, c = constant without the subscript
1:Direct NTB effect
2:Direct NTB and tariff effects
3:Direct NTB and tariff effects and NTB importer diversion
4:All effects of barriers constant
5:Variable direct NTB effect
6:Variable direct NTB effect and constant direct tariff effect
7:Variable direct NTB effect and all other effects
8:Full model

Table 7

Estimates of Effects of Barriers
exp (β)

Model	NTB_{ik}	TAR_{ik}	$NTB_{i''k}$	$TAR_{i''k}$
1	.801			
2	.815	.635		
3	.544		.0043	
4	.550	.695	.0047	.032
5	1.629[1]			
6	1.623[1]	1.168		
7	1.962[1]	1.196	4.017	3.747
8	20.56[1]	exp(320)[2]	21.501	.303

[1] $(\Sigma\ \beta_i)\ /\ 14\ +\ (\Sigma\ \beta_k)\ /\ 163.$
[2] $(\Sigma\ \gamma_i)\ /\ 14\ +\ (\Sigma\ \gamma_k)\ /\ 163.$

Table 8

Adjusted R^2's and t-values of Effects of Barriers

Model	R^2	k	NTB_{ik}	TAR_{ik}	$NTB_{i''k}$	$TAR_{i''k}$
1	0.7383	185	-2.24			
2	0.7383	186	-2.01	-0.76		
3	0.7435	186	-5.35		-6.73	
4	0.7433	188	-5.08	-0.49	-6.49	-0.51
5	0.7732	360 nf	3.09[1]			
6	0.7730	361 nf	3.08[1]	.23		
7	0.7730	363 nf	2.79[1]	.22	1.34	.20
8	0.7894	543 nf	1.93[1]	3.00[1]	2.74	-0.12

[1] F statistic for testing if the coefficient is constant across importer, commodity.

number of observations = 2387
k = number of parameters
nf = deficient rank

Table 9

Effects of NTB's by Importer
Bivariate Model

	NTB Avg (1)	Overall Effect (2)	NTB AVG (3)	NTB Elast (4)
Finland	.351	-.140	.347	-.404
Switzerland	.467	-.097	.463	-.209
France	.261	-.060	.259	-.232
Norway	.150	-.048	.147	-.329
United States	.111	-.029	.111	-.262
Netherlands	.166	-.021	.156	-.134
Denmark	.110	-.019	.106	-.175
West Germany	.105	-.018	.102	-.174
Great Britain	.118	-.017	.118	-.144
Belgium &Lux.	.124	-.017	.117	-.142
Greece	.074	-.016	.072	-.223
Italy	.087	-.016	.086	-.186
Ireland	.049	-.009	.049	-.180
Japan	.385	.038	.421	.091

(1) Import Weighted Coverage Ratio
(2) Counterfactual 1'
(3) (2) / (4)
(4) Counterfactual 1

Counterfactual 1: By how much would imports of country i decrease if its coverage ratio applicable to all exporters and all commodities increased from zero to one-hundred per cent ($\Delta\ NTB_{ik} = 1$):

$$\sum_k M_{ik}\ (\beta_i + \beta_k)\ /\ \sum_k M_{ik}$$

Counterfactual 1': By how much would imports of country i decrease if its coverage ratios increased from zero to the observed value NTB_{ik} ($\Delta NTB_{ik} = NTB_{ik}$):

$$\sum_k M_{ik}\ NTB_{ik}(\beta_i + \beta_k)\ /\ \sum_k M_{ik}$$

Table 10

Effects of Tariffs by Importer

	TAR Avg (1)	Overall Effect (2)	TAR AVG (3)	TAR Elast (4)
Norway	.053	-.063	.051	-1.231
Great Britain	.029	-.033	.029	-1.141
West Germany	.027	-.029	.026	-1.127
Italy	.016	-.027	.015	-1.760
Japan	.034	-.026	.030	-.864
United States	.041	-.024	.037	-.640
Netherlands	.017	-.019	.017	-1.157
Greece	.014	-.018	.013	-1.333
Belgium &Lux.	.012	-.016	.012	-1.430
France	.019	-.016	.018	-.852
Switzerland	.028	-.012	.025	-.499
Ireland	.018	-.011	.018	-.594
Denmark	.029	-.005	.025	-.212
Finland	.048	.046	.051	.893

(1) Import Weighted Tariff Average
(2) Counterfactual 1'
(3) (2) / (4)
(4) Counterfactual 1

Counterfactual 1: By how much would imports of country i decrease if its tariff average applicable to all exporters and all commodities increased from zero to one-hundred per cent ($\Delta\ Tar_{ik} = 1$):

$$\sum_k M_{ik}\ (\beta_i + \beta_k)\ /\ \sum_k M_{ik}$$

Counterfactual 1': By how much would imports of country i decrease if its tariff averages increased from zero to the observed value Tar_{ik} (ΔTar_{ik} = Tar_{ik}):

$$\sum_k M_{ik}\ Tar_{ik}(\beta_i + \beta_k)\ /\ \sum_k M_{ik}$$

Table 11

Combined Effect of Tariff and Nontariff Barriers

	NTB Effect	Tariff Effect	Total Effect
Norway	-.048	-.063	-.111
Switzerland	-.097	-.012	-.109
Finland	-.140	.046	-.094
France	-.060	-.016	-.076
United States	-.029	-.024	-.053
Great Britain	-.017	-.033	-.050
West Germany	-.018	-.029	-.047
Italy	-.016	-.027	-.043
Netherlands	-.021	-.019	-.040
Greece	-.016	-.018	-.034
Belgium &Lux.	-.017	-.016	-.033
Denmark	-.019	-.005	-.024
Ireland	-.009	-.011	-.020
Japan	.038	-.026	.012
AVERAGE	-.027	-.009	-.036
AVERAGE(excluding +)	-.029	-.012	-.037

Table 12
Models With Importer Comparative Advantage Variables

	α	η_{ik}	(β_0	β_m)	(γ_0	γ_m)	(β'')	(γ'')
1	*	*	*					
2	*	*	*		*			
3	*	*	*		*		*	
4	*	*	*		*		*	*
5	*	*	*	*				
6	*	*	*	*	*			
7	*	*	*	*	*		*	*
8	*	*	*	*	*	*	*	*

Cases: * = included
1:Direct NTB effect
2:Direct NTB and tariff effects
3:Direct NTB and tariff effects and NTB importer diversion
4:All effects of barriers constant
5:Variable direct NTB effect
6:Variable direct NTB effect and constant direct tariff effect
7:Variable direct NTB effect and all other effects
8:Full model

Table 13

Estimates of Effects of Barriers: Bivariate Model
Models With Importer and Exporter Comparative Advantage Variables
exp(β)

Model	NTB_{ik}	TAR_{ik}	$NTB_{i''k}$	$TAR_{i''k}$
1	0.453			
2	0.535	0.043		
3	0.407	0.047	0.028	
4	0.411	0.034	0.032	0.007
5	0.560[a]			
6	0.680[a]	0.031		
7	0.555[a]	0.024	0.081	0.004
8	0.604[a]	0.007[a]	0.102	0.016

a = average

Table 14

Adjusted R^2's and t-values of Effects of Barriers: Bivariate Model Models With Importer and Exporter Comparative Advantage Variables

Model	R^2	k	NTB_{ik}	TAR_{ik}	$NTB_{i''k}$	$TAR_{i''k}$
1	0.7084	177	-8.35			
2	0.7119	178	-6.30	-5.29		
3	0.7141	179	-7.63	-5.13	-4.27	
4	0.7140	180	-7.49	-4.51	-4.05	-0.71
5	0.7137	181	11.25[1]			
6	0.7178	182	12.47[1]	-5.75		
7	0.7188	184	10.40[1]	-4.93	-2.93	-0.80
8	0.7222	188	12.88[1]	7.73[1]	-2.67	-0.60

[1] F statistic for testing equality of coefficients

Table 15

t-values for Comparative Advantage Component of the Model.

	Country			Industry Interaction	
	GNP	POP	Land	POP	Land
1	37.61	2.72	-12.27	0.82	-3.42
2	38.09	1.97	-11.69	1.21	-3.59
3	38.02	1.58	-11.45	1.33	-3.64
4	37.76	1.58	-11.46	1.34	-3.62
5	36.06	1.27	-9.45	1.09	-4.43
6	36.50	0.34	-8.46	1.41	-4.57
7	36.31	0.26	-8.60	1.48	-4.58
8	36.71	2.58	-9.48	0.30	-4.34

Table 16

Estimates of Effects of Barriers: Bivariate Model
Models with Disaggregated NTB Variables

	PRICE	QUOTA	CONTR	THREAT	TAR	NTB"	TAR"
A2	0.797	1.005	0.823	0.751	0.670	----	----
A4	0.690	0.848	0.669	0.618	0.577	0.009	0.011
B2	1.134	0.874	0.404	0.893	0.037	----	----
B4	1.066	0.790	0.344	0.813	0.020	0.057	0.0001

Table 17

Adjusted R^2's and t-values of Effects of Barriers: Bivariate Model
Models with Disaggregated NTB Variables

Model	R^2	k	PRICE	QUOTA	CONTR	THREAT	TAR	NTB"	TAR"
A2	.7384	189	-1.53	0.03	-1.65	-1.35	-0.67	---	---
A4	.7428	191	-2.49	-1.03	-3.29	-2.25	-0.74	-6.06	-0.67
B2	.7157	181	0.84	-0.81	-8.13	-0.54	-5.61	---	---
B4	.7176	183	0.43	-1.40	-8.99	-0.98	-5.31	-3.60	-1.30

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List of Figures

Figure 1

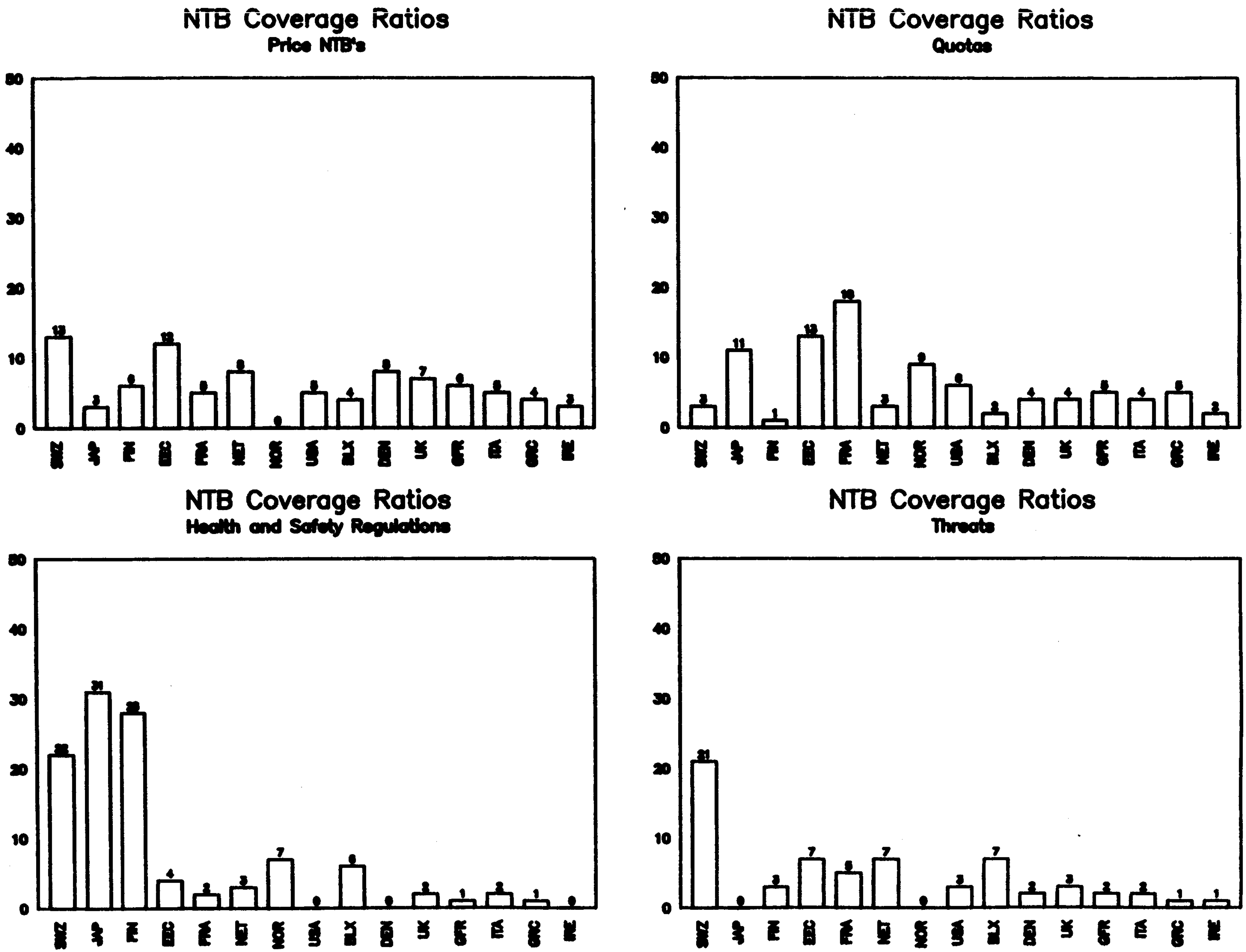
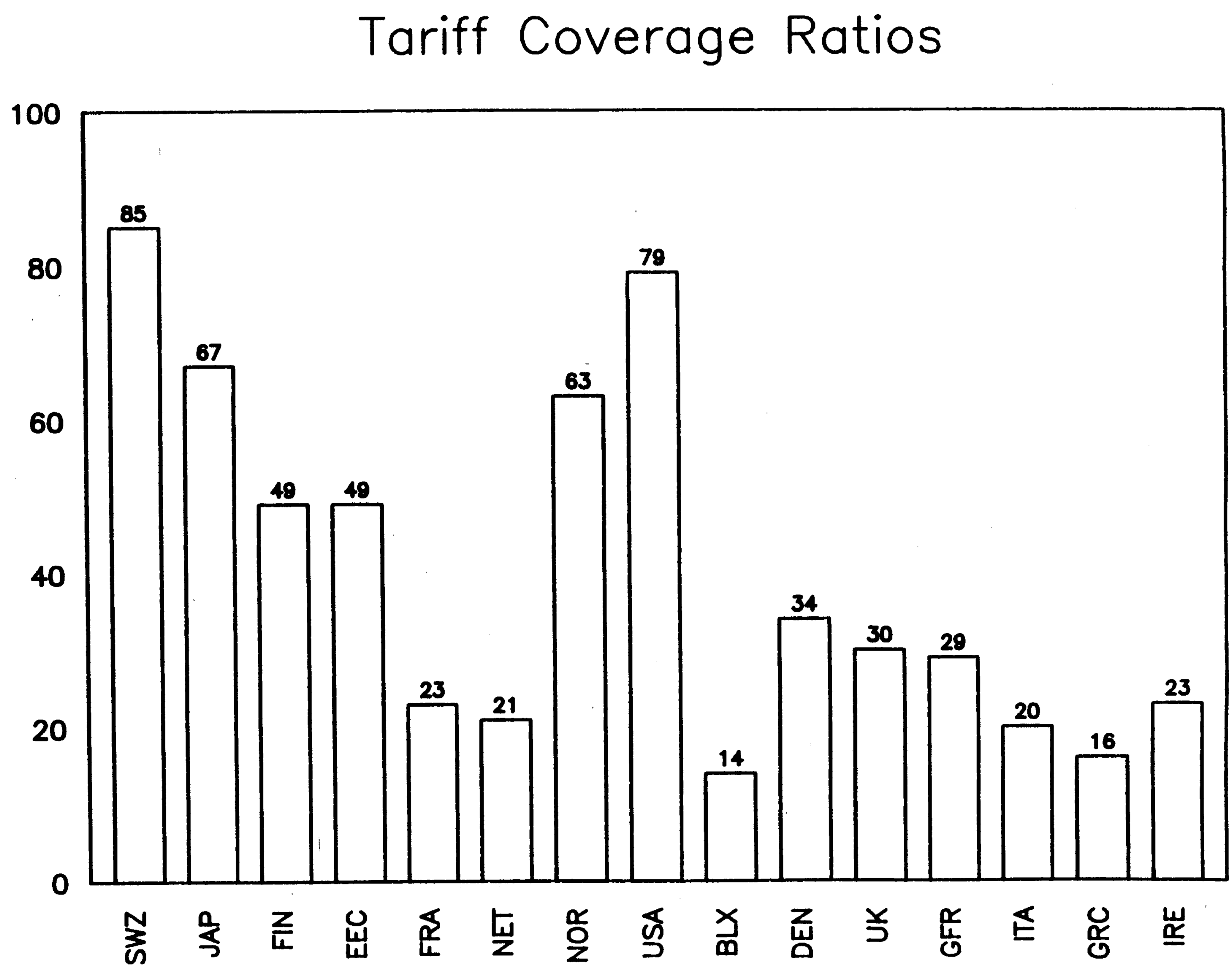

NTB Coverage Ratios
Price NTB's
NTB Coverage Ratios
Quotas
NTB Coverage Ratios
Health and Safety Regulations
NTB Coverage Ratios
Threats

figure 2a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40
20
0
85
67
49
49
23
21
63
79
14
34
30
29
20
16
23
SWZ
JAP
FIN
EEC
FRA
NET
NOR
USA
BLX
DEN
UK
GFR
ITA
GRC
IRE

Figure 2b

Tariff Rates

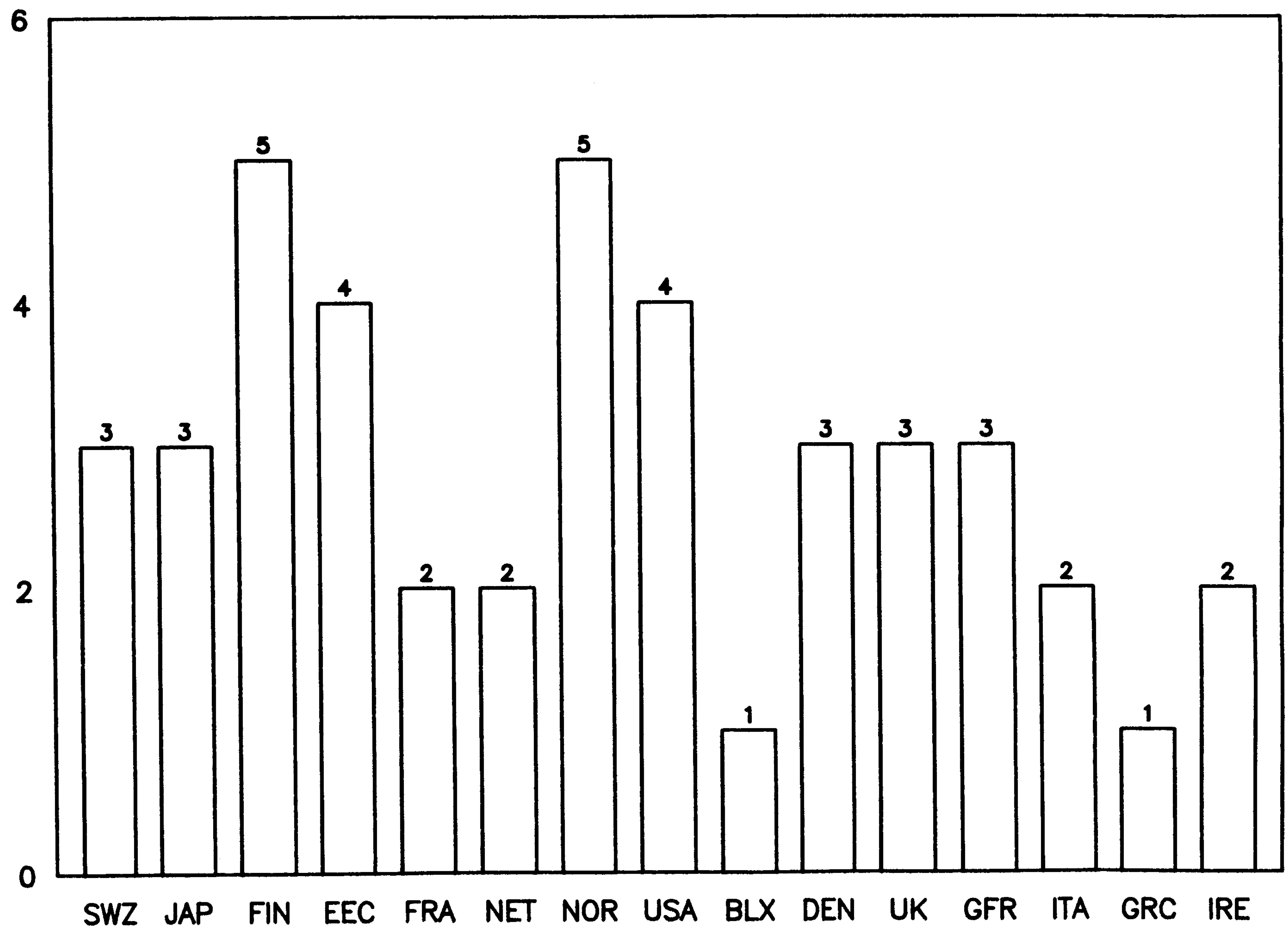
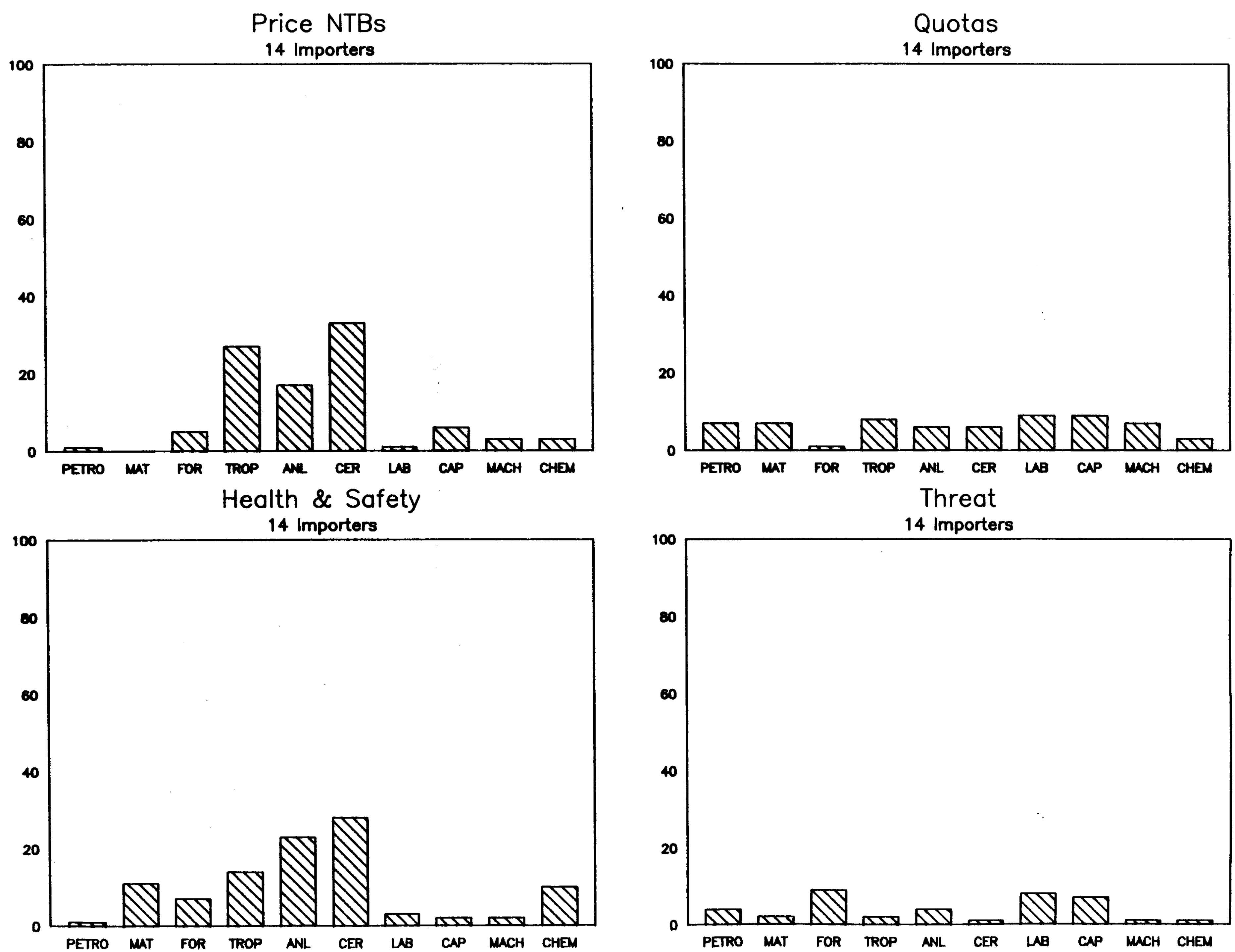


Figure 3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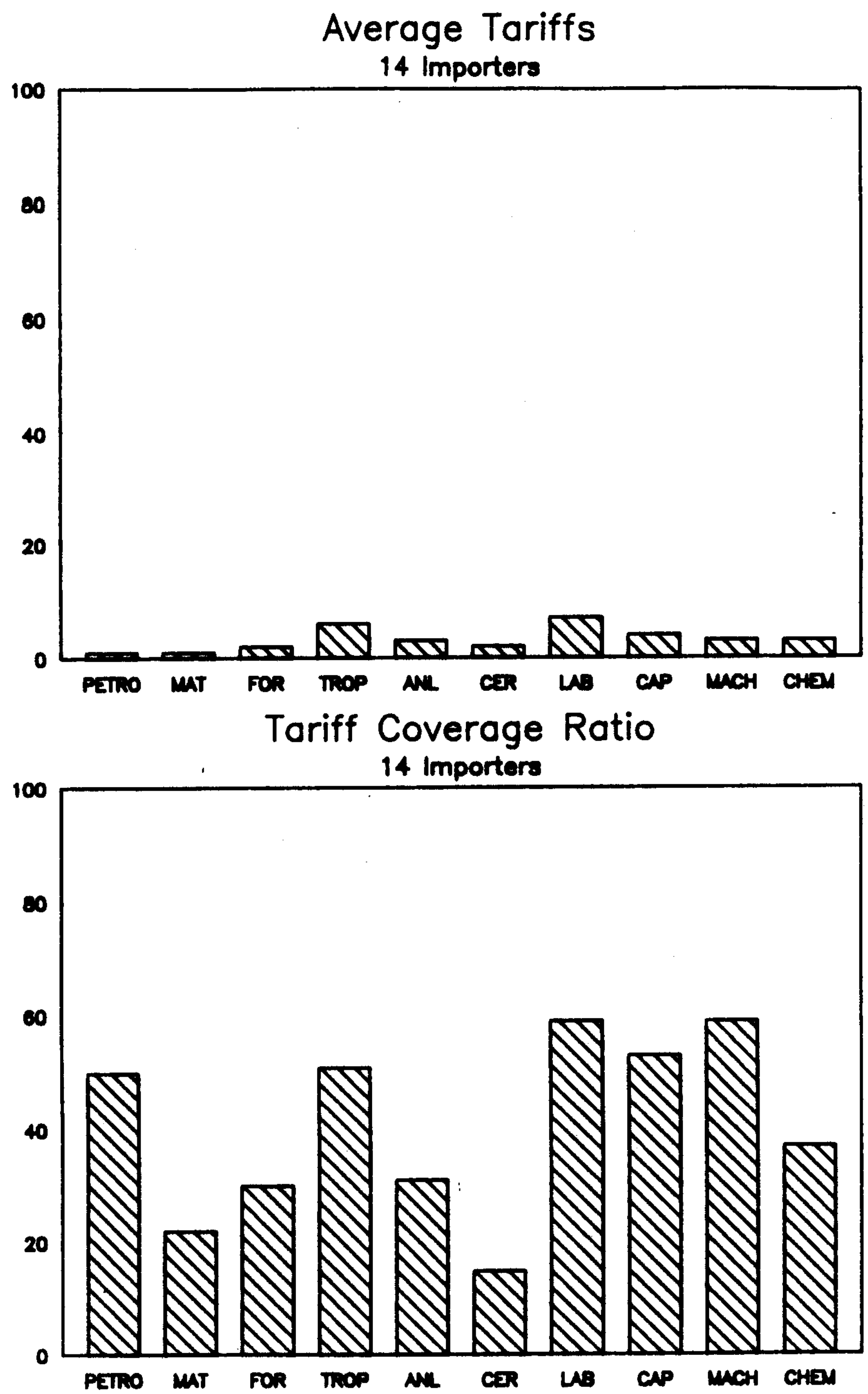
80
60
40
20
0
PETRO
MAT
FOR
TROP
ANL
CER
LAB
CAP
MACH
CHEM
Quotas
14 Importers
Health & Safety
14 Importers
Threat
14 Importers

Figure 4



Average Tariffs
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80
60
40
20
0
PETRO
MAT
FOR
TROP
ANL
CER
LAB
CAP
MACH
CHEM
Tariff Coverage Ratio
14 Importers
100
80
60
40
20
0
PETRO
MAT
FOR
TROP
ANL
CER
LAB
CAP
MACH
CHEM