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Jon D. Haveman
Public Policy Insitute of California

U. C. Nair
Purdue University

Jerry Thursby
Georgia Institute of Technology

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Purdue University

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Center for International Business Education and Research
Purdue University
Krannert Graduate School of Management
1310 Krannert Building
West Lafayette, IN 47907-1310
Phone: (765) 494-4463
FAX: (765) 494-9658

THE EFFECTS OF PROTECTION ON THE PATTERN OF TRADE: A DISAGGREGATED ANALYSIS(a)

Professor Jon Haveman, Purdue University
Professor Usha C. Nair, Georgia Institute of Technology
Professor Jerry G. Thursby, Purdue University

ABSTRACT

We analyze the effects of protection using disaggregated data. This permits analysis of distinct effects of tariffs and NTBs on trade. Our analysis indicates that tariffs tend to shift trade towards larger exporters. We find significant trade diversion caused by tariffs. In the case of NTBs, we find that quantitative barriers are more likely to raise prices than are price restrictions. Quantity barriers appear to lead exporters to concentrate on higher priced varieties. We do not find much evidence to suggest that countries not targeted by an NTB gain at the expense of targeted countries. We find that NTBs tend to substitute for tariffs.

INTRODUCTION

This paper extends the literature[1] on the impact of protection by analyzing the impact of tariffs and non-tariff barriers (NTBs) at a more disaggregated level than usual – 6-digit rather than 3 or 4-digit. The data are from the UNCTAD TRAINS data base, which is an inventory of bilateral tariffs, NTBs, and trade flows for much of the world. The extent of the data and level of disaggregation permit a more detailed inquiry than is generally the case. The literature is largely case studies of specific commodities and broader studies based on data aggregated to the 3 or 4-digit industry levels. Case studies are clear as to effects of NTBs, but they are limited in scope so that it is hard to generalize to questions regarding the overall level of world trade for various commodity classifications. The other studies address issues regarding the overall effects on trade, but they are flawed by their reliance on highly aggregated data. There are several advantages to a disaggregated approach. First, it allows for large samples so that we can consider regressions for narrow commodity groups; this mitigates specification error due to structural differences in the determinants of trade flows across commodities. Second, a disaggregated approach enables us to obtain improved estimates of both the direct and diversionary impact of tariffs and NTBs on imports and to analyze more precisely the effectiveness of various types of NTBs in reducing imports and diverting trade. Finally, regressions on a large number of commodity classifications allows for generalities not possible using case studies.

GENERAL COMMENTS ON THE EFFECTS OF BARRIERS

Simple theories of protection focus on markets with homogenous products and do not include provisions for preferential tariffs or NTBs imposed on the same good imported from different countries. Predictions from these theories are well-known: the value and volume of imports fall with the imposition of a tariff, while quantitative or qualitative restrictions will lower the volume of imports but may raise or lower the value of imports depending on domestic supply and demand elasticities.

The case of preferential or non-uniform tariffs, where a country imposes different tariff rates for the same commodity against different trading partners, has been widely discussed. The general conclusion is that preferential tariffs result in trade diversion from high to low tariff countries. In a frictionless model, there are two effects in both a monopolistic competition and a homogeneous goods world. In monopolistic competition, the aggregate increase in price may result in a reduction of consumption within the industry, while the preferential nature of the trade barrier, and hence price changes, will reshuffle consumption across varieties from high to low tariff varieties. We should witness two influences on bilateral trade with any country: that due to the average level of tariffs, and that due to the differential between its own tariff and the average of all other tariffs imposed on the same good. When goods are homogeneous, we also expect trade to become concentrated in low tariff countries. If trade is eliminated between the

importer and some exporters as a result of the trade barrier, then the concentration of trade in the low-tariff countries may well increase the flow above the level one would predict based upon the established "norm." Generalizations of these frameworks can lead to additional insights into the effects of trade barriers.

Consider, for example, a uniform tariff increase against all partners. Further, assume the reasonable proposition that there are fixed costs in trading a good with any particular country. In a monopolistically competitive model, country i exhibits an aggregate demand for variety in goods and hence trades with all countries. A uniform tariff across partner countries would result in a uniform contraction of trade, as consumers in i still demand the same number of varieties of the good, but less of each. In other words, a uniform tariff would have the same percentage impact on imports from both small and large trading partners and will not result in trade diversion. Fixed costs in this case have no impact. Suppose instead that trade is in homogeneous goods and involves fixed costs associated with trade. In order to minimize these costs, we expect to see trade with as few countries as possible; variety here has no value. A uniform tariff increase in this case can have two effects on exports from countries with which the importing country still trades: a trade reducing effect of the tariff on imports from j, and an offsetting trade diverting effect, where trade is diverted from secondary to primary trading partners. In other words, a uniform tariff will divert trade from small to large exporters. Note the possibility that the value of trade rises for pairs of countries that continue to trade. Hence, we have two different, model specific predictions in the case of uniform tariffs when there is a fixed cost of trading: that of no diversion in a model with monopolistically competitive trade, and diversion from small trading partners to large trading partners in the case of homogenous goods.

In sum, the presence of fixed costs of trade and/or preferential tariffs and NTBs can generate seemingly perverse results. Observed bilateral flows in the presence of a tariff may, on average, be larger than one might expect. With preferential tariffs, consumption of low-tariff varieties in a model with differentiated goods will increase, offsetting the reduction caused by the aggregate price increase, while in the homogenous goods framework, trade becomes concentrated in low-tariff countries. Trade flows with large partners may also be, on average, larger than expected in the homogeneous goods setting when we consider fixed costs of trading: the trade reducing effect of tariffs on imports from a large trading partner is offset by trade diversion from a small to a large trading partner; this would not occur in the absence of fixed costs because importers are indifferent between suppliers, or the number of suppliers. NTBs, on the other hand, have only an indirect effect on prices through import restrictions, unlike tariffs that raise domestic prices directly. Hence, while the volume of imports declines as a result of an effective NTB, its effect on the value of imports depends upon elasticities of domestic demand and supply. In other words, it is possible that an effective NTB may lead to an increase in the value of imports.

DATA AND EMPIRICAL SPECIFICATION

The TRAINS data is an inventory of bilateral tariffs, NTBs, and trade flows for much of the world. We limit observations to 15 importers and 65 exporters; see Table 1 for countries.[2] Data for each bilateral pair relates to a specific year during the period 1988-1992. The barrier data is at the tariff line; generally the 8 or 10-digit Harmonized Tariff System (HS) level. The trade data, however, is only present at the 6-digit HS level; thus we are limited to observations at this level. For this study we obtain regression results for data grouped according to 2-digit SITC groups; the groups chosen are in Table 2 along with the number of HS codes and observations for each 2-digit group.[3] That is, each set of regression results is based on all of the 6-digit HS codes that are in a particular 2-digit SITC group. For example, one of our groups is footwear. There are 25 6-digit HS codes that make up this group; thus the footwear regression covers these 25 HS codes for each of the 15 importers and 65 exporters.[4]

The empirical specification is a regression of the logarithm of bilateral imports of good k imported by country i from exporter j, on four sets of regressors: i) commodity dummy variables, ii) importer and exporter dummy variables, iii) variables to capture tariff and non-tariff barrier effects, and iv) additional country pair effects.

TRADE FLOW DATA: A trade flow observation from TRAINS, at the 6-digit HS level, is the dollar value of bilateral imports for individual country pairs i and j. For many country combinations the trade flow is zero, thus we augment the TRAINS flow data with zero flow observations for country pairs with no reported trade. Inclusion of the zero flow

observations avoids bias and inconsistency induced when zero flow observations are omitted from the sample. We do not, however, include zero observations when the exporter does not export this good to any country, or the importer does not import the good from any country.[5]

COMMODITY DUMMY VARIABLES: Though we include only related commodities within each regression, there may still remain some commodity specific effects. Hence we include commodity dummy variables to mitigate the potential for bias and inconsistency that may arise from these systemic differences. There are separate dummy variables for each 6-digit HS code in a regression sample.

TABLE 1: IMPORTERS AND EXPORTERS

IMPORTERS				
Australia	European Union	Japan	Norway	Switzerland
Austria	Finland	Korea, Rep. Of	South Africa	Taiwan
Canada	Hong Kong	New Zealand	Sweden	United States
EXPORTERS				
Algeria	Congo	Indonesia	Norway	Sri Lanka
Australia	Czech rep.	Ireland	Oman	Sweden
Austria	Denmark	Italy	Pakistan	Switzerland
Bangladesh	Ecuador	Japan	Panama	Taiwan
Belgium	Egypt	Kenya	Paraguay	Thailand
Bolivia	Ethiopia	Korea, Rep. Of	Peru	Trinidad/Tobago
Brazil	Finland	Malaysia	Philippines	Tunisia
Brunei	France	Mexico	Poland	Turkey
Bulgaria	Germany	Morocco	Portugal	United Kingdom
Canada	Greece	Nepal	Saudi Arabia	United States
Chile	Hong Kong	Netherlands	Singapore	Uruguay
China	Hungary	New Zealand	South Africa	Venezuela
Colombia	India	Nigeria	Spain	Yugoslavia

TABLE 2: TWO DIGIT SITC GROUPS

SITC	Description	# HS Codes	No. Observations	Industry Type[6]
02	Dairy products, eggs	23	5884	Animal products
06	Sugar, honey	15	4497	Tropical agr. products
24	Wood, lumber, cork	27	11915	Forest products
26	Textile fibers	64	22034	Cereals
28	Metalliferous ores, metal scrap	50	19934	Raw materials
32	Coal, coke, briquettes	8	2689	Raw materials
33	Petroleum, petroleum products	25	10142	Petroleum
58	Plastic materials, cellulose	88	43993	Chemicals
61	Leather, dressed furskins	34	19184	Capital-intensive
62	Rubber manufactures, n.e.s.	39	23256	Capital-intensive
64	Paper, paperboard	116	52881	Forest products
71	Machinery, other than elec.	68	31628	Machinery
73	Transport equipment	72	32831	Machinery
82	Furniture	28	16870	Labor-intensive
85	Footwear	25	14333	Labor-intensive

COUNTRY SPECIFIC DUMMY VARIABLES: The use of importer and exporter dummy variables eliminates country-specific effects. Note that by including country dummies, we also control for the effects of the share of importer country i in total world spending as well as the output of industry k in exporter j. The share effect clearly

folds directly into the relevant importer dummy, while the output effect has both country and commodity components. It should be noted that industry production in country j is not what we would optimally include in the regression; ideally, we would include the determinants of industry production in country j.[7] These determinants are country-specific and, if their effects are assumed to be constant across the industries included in each regression, then they are folded into the exporter dummy variables. The use of country dummies also avoids potential measurement errors that may arise from alternative approaches such as the explicit use of factor endowments.

COUNTRY PAIR EFFECTS: The country pair effects (other than tariff and NTB effects) are a measure of the distance between trading partners, D_{ij}, a dummy variable indicating the existence of a common border, A_{ij}, and a dummy variable indicating that the countries share a common primary language, $LANG_{ij}$.

TRADE BARRIER DATA: Our protection variables are designed to pick up effects that other studies have not explicitly addressed. The set of effects picked up by our tariff variables are industry substitution effects, variety substitution effects and trade compression effects, while NTBs result in direct effects, tariff-mitigating effects and diversion effects. In what follows, we define these effects and the variables designed to capture their impact.

Our analysis requires data for tariffs and NTBs at the 6-digit HS level; however, such data are available at the tariff line level. Each 6-digit HS code may comprise one or more tariff lines. We calculate the tariff for each 6-digit HS category as the simple average across all tariff lines in that category. The TRAINS database manual lists 80 different NTBs. We divide these NTBs into four types on the basis of similarity in their administrative structure and their primary effects. The NTB categories depend on whether they have direct price effects (PRICE), quantity restrictions (QUANT), quality restrictions (QUAL), or involve a threat of retaliation (THREAT). The measure for NTBs imposed against each 6-digit HS category is the proportion of tariff lines under each 6-digit HS code subject to the NTB. For example, if there are four tariff lines associated with a particular 6-digit HS code, and country i imposes a quantity restriction on imports from country j for three of the four tariff lines, then we record the value 0.75 for the quantity NTB for importer i and exporter j. In a sample of product categories we found that a majority (more than 90%) of NTBs are imposed against all tariff lines for a 6-digit HS category, hence one can loosely interpret measures of NTBs as dummy variables for the presence or absence of an NTB.

An important difference between our data and the data used in more aggregated studies is that we avoid the standard practice of trade weighting the protection data with own imports. Trade weighting induces simultaneous equations bias since the dependent variable in the trade regressions (the value of trade) is used to form a regressor. Since our data are highly disaggregated, and since the majority of NTBs are imposed against all tariff lines for a 6-digit HS category, trade weighting of NTBs is unnecessary. For tariff variables we calculate the average tariff (across countries) for each 6-digit HS category, k, by weighting the tariff data by EX_{jk}, country j's exports of the 5-digit HS category, k, that includes the 6-digit HS category, k. While aggregation issues still exist, they are substantially less than is the case with more aggregated studies. The possibility of simultaneity is substantially reduced by use of 5-digit aggregates since the left hand side (a 6-digit flow value) is generally a small portion of the 5-digit aggregate.

TARIFFS: There are three effects of tariffs that we investigate. Our framework incorporates a nested constant elasticity of substitution utility function: there is a constant elasticity of substitution between a given product and all other goods and a different elasticity between varieties of the same good. Within this framework, we can define a price index over varieties within an industry. Changes in this price index will lead consumers to substitute away from this industry; this is our industry substitution effect. In the empirical specification, changes in this price index are represented by $\bar{\tau}_{ik}$, a trade weighted average of τ_{ijk}, the tariff between i and j for HS category k:

$$\bar{\tau}_{ik} = \sum_j EX_{j\kappa} * \tau_{ijk} / \sum_j EX_{j\kappa} \tau_{ik}$$

where $EX_{j\kappa}$ is country j's exports of the 5-digit HS category, κ, that includes the 6-digit HS category, k. As $\bar{\tau}_{ik}$ rises, ceteris paribus, so does the industry price index.

The second tariff effect, the variety substitution effect, is a diversion from one variety of the good to another.

We capture that effect with $\tau_{ijk} - \bar{\tau}_{ik-j}, \bar{\tau}_{ik-j}$ is similar to $\bar{\tau}_{ik}$ except that exporter j is excluded from its calculation. This variable captures the differential between the tariff on country j's exports and the average tariff on competing varieties. The effect is expected to be negative; high tariffs divert trade away from this exporter.

For several reasons we expect the number of trading partners to decline when a tariff is imposed, be it uniform or preferential; this is the trade compression effect. In either case, it is hypothesized that a tariff concentrates a reduced volume of trade among a smaller number of countries. Our prior is that trade with small exporters will cease and be compressed into larger exporters. Our final tariff variable is then $EX_{j\kappa} * \bar{\tau}_{ik}$. We expect higher tariffs to have a disproportionately small impact on larger exporters and hence anticipate a positive effect for this variable.

NON-TARIFF BARRIERS: Similarly, there are three separate influences of non-tariff barriers. The first is the direct effect. As discussed above, an NTB can increase or decrease the value of trade, depending on elasticities. Hence, the sign of the coefficients on the NTB variables is dependent on same elasticities. The tariff-mitigation effect arises from the coincident application of a tariff and an NTB. The variable capturing this effect is $\tau_{ijk} * NTB_{ijk}$; it is expected to have an effect opposite in sign from the effect on the NTB variable. We expect this effect because a tariff will already reduce the level of trade and the NTB will have a smaller effect when applied to artificially smaller trade. Finally, we check the diversion effect; the extent to which the NTB diverts trade from exporters with the NTB to exporters not covered. This is captured by NTB_j; a variable that is positive and equal to the proportion of other exporters covered by the NTB when exports from j are not covered by the NTB and is zero when country j exports are covered by the NTB. It is expected that trade will increase for countries not covered by the NTB.

ESTIMATING EQUATION: For each product category k, we estimate:

$$\begin{aligned}\log(m_{ijk}) = {} & \alpha + \varphi(E_j) + \lambda(M_i) + \omega(HS) + \phi(D_{ij}) + \gamma(A_{ij}) + \eta(LANG_{ij}) + \delta\log(1+\bar{\tau}_{ik}) \\ & + \mu\log(1+\tau_{ijk}-\bar{\tau}_{ik-j}) + \kappa\log(EX_{\kappa j} * \bar{\tau}_{ik}) + \chi_1 THREAT_{ijk} + \chi_2 PRICE_{ijk} + \chi_3 QUANT_{ijk} \\ & + \chi_4 QUAL_{ijk} + \chi_{11}\tau_{ijk} * THREAT_{ijk} + \chi_{21}\tau_{ijk} * PRICE_{ijk} + \chi_{31}\tau_{ijk} * QUANT_{ijk} \\ & + \chi_{41} t_{ijk} * QUAL_{ijk} + \chi_{12} THREAT_{ik-j} + \chi_{22} PRICE_{ik-j} + \chi_{32} QUANT_{ik-j} + \chi_{42} QUAL_{ik-j} + u_{ijk}.\end{aligned}$$

Where m_{ijk} is the US dollar value of the trade between two countries. The independent variables include importer and exporter-specific dummies (M_i and E_j), a set of 6-digit HS commodity dummy variables (HS), as well as variables that capture between-country effects: distance, adjacency, and commonality of language. For each regression, we have as many as 15 importers and 65 exporters as well as numerous 6-digit HS categories. However, not all exporters are represented in each regression. If a country does not export a commodity to any of the 15 importers, it is excluded from the regression. In addition, missing tariff data can reduce the number of countries.

METHOD OF ESTIMATION

As our dataset contains a large number of zero values for the dependent variable we use a standard Tobit estimator. The existence of simultaneous equation bias has been widely discussed. For the following reasons, we are not concerned about this as in the present setting. In our regression, the potential for simultaneity arises from two sources. First, there is the endogenous protection argument that, while protection is directed at reducing imports, high levels of imports are a cause of protection. Note, however, that barriers are imposed prior (often, years prior) to the observations on flows. A past trade flow may be the cause of a barrier, but current flows cannot cause the imposition of a barrier in the past. Second, we use $EX_{j\kappa}$, country j's exports of the 5-digit HS category, κ, that includes the 6-digit HS category, k, to weight our tariff variables. In our case, this source of bias and inconsistency is quite small because of the level of disaggregation. $EX_{j\kappa}$ is country j's exports of the 5-digit HS category, κ, that includes the 6-digit HS category, k; hence, each trade flow observation at the 6-digit HS code, k, on the left hand side of the regression is only a small part of $EX_{j\kappa}$ on the right hand side of the regression.

Prior studies have encountered another potential source of simultaneity: the use of trade weighted measures of barriers to trade in order to aggregate to 3- or 4-digit SIC level. Trade weights are used to aggregate barriers because barriers are typically imposed against only a fraction of the commodities in each 3- or 4-digit aggregation. Trade

weighted measures clearly introduce bias since the left-hand-side variable (trade flow) is also found on the right-hand-side of the regression. We do not use trade weighted measures to aggregate from the tariff lines to the 6-digit HS codes, because the barriers are typically imposed against all tariff lines in a 6-digit HS catagory.[8]

There is a potential source of error that may be present in disaggregated studies that may not be present in more aggregated data. If an NTB is non-binding (for example, a quota where actual trade is less than the quota), measurement error in the NTB variable is present. While the effect of measurement error in a regressor is statistically identical to the effect of simultaneous equations error, the remedy is not the same; that is, instrumental variables estimation is not possible in this setting. With highly aggregated data, one is less likely to find a non-binding restriction across all commodities in a three or four digit industry category. Of course, the aggregation error when using three or four digit data may be substantially greater than the error from non-binding barriers.

ISSUES ON THE INTERPRETATION OF RESULTS

Before we discuss regression results, it is useful to outline a general framework for interpreting the results. Let us consider a pair of countries, i, and j. When, ceteris paribus, trade between i and j is "large" or "out-of-line" in comparison with trade in that good for other exporters, we say that trade is "large" between i and j. On the other hand, if trade is small in comparison with other countries, we say that trade is "small." Finally, if the level of trade is similar, we will say that trade is "normal."

Importers choose to impose barriers for a number of reasons. Trade need not necessarily be large for a trade barrier to be imposed. A barrier can be imposed against all exporters when trade is normal for all exporters; for instance, to protect a declining industry. It is also possible that a barrier could be selectively imposed against j when trade is small. This case is unlikely as it implies that a barrier is imposed against countries with whom trade is small, but not against exporters for whom trade is large or normal. However, we cannot rule out this case since barriers are often imposed for political reasons, such as barriers imposed against Iraq following the invasion of Kuwait. However, it seems reasonable to state that it is least common for barriers to be imposed when trade is small.

Interpretation of the sign of coefficients on barriers to trade is not as straightforward as implied by some discussions in the literature on the effects of barriers. Researchers have generally expected significant, negative or insignificant effects. Positive, significant results often are considered to imply errors in the econometric methods employed, in model specification, or in measures of the barriers. However, if a barrier is imposed against a country and good for which trade is large, then a positive and significant barrier coefficient means that the barrier was not effective, or that it had an effect in lowering trade but it did not lower trade below or commensurate with that of other countries. Regression coefficients measure partial correlations: a positive coefficient on a barrier only implies positive partial correlations between trade and the barrier to trade.

Note that an insignificant coefficient does not necessarily imply an ineffective barrier. It can mean that the barrier was imposed against a good and country where trade was large and the barrier was effective in bringing trade back to a normal level. A negative, significant coefficient would appear to unambiguously imply an effective barrier. However, this is not necessarily the case. If the barrier is imposed against a country with small trade, then the coefficient could be negative and significant even if the barrier has no effect on trade. In what follows, we illustrate, for our particular set of variables, just what particular coefficient values might or might not mean.

The following table gives possible outcomes for coefficients on our average tariff measure, $\bar{\tau}_{ik}$, and our trade diversion variable, $\tau_{ijk} - \bar{\tau}_{ik-j}$. Column headings refer to the trade level descriptions given above. Row headings refer to whether the tariff measure does or does not effect trade. Note, " - "means negative and significant and " + " means positive and significant while " 0 " means insignificant (regardless of the sign of the coefficient).

	Large	Normal	Small
Effective	+, 0, -	-	-
Not Effective	+	0	-

A few conclusions can be reached from an examination of the tariff measures. First, a positive, significant coefficient implies that the barrier has been imposed where trade is large, regardless of whether the barrier is effective. Second, an insignificant coefficient implies that a barrier was not imposed in a situation where trade was small; again, regardless of whether it is effective. Finally, if we are willing to rule out the possibility that, as a general rule, barriers are imposed where trade is small, or that such a case is rare (a reasonable position), then a negative, significant coefficient implies an effective barrier.

The coefficients on the NTB variables are subject to similar, though more complicated interpretations. The complication arises because an effective barrier may well yield an increased value of trade. Beginning with the raw NTB variable, the indicator of whether or not a given country is subject to the NTB, we find the following sets of relationships to be plausible. Again, interpret the column headings as describing the level of unprotected trade between the importer and a particular exporter and the row headings refer to whether or not the barrier is effective.

	Large	Normal	Small
Effective	+, 0, -	+,-	+, 0, -
Not Effective	+	0	-

First, if we rule out cases where barriers are imposed against small trade countries, then a negative coefficient tells us that the barrier was effective. Second, a positive, significant coefficient where trade is large may imply that the NTB is ineffective or that it did not lower trade commensurate with that of other countries. In the case where trade is normal, a positive, significant coefficient implies that an effective NTB may have increased the value of trade

Considering our NTB diversion variables, let the columns of the following table describe unprotected trade between countries, m, with whom the importer, i, does not impose the NTB.

	Large	Normal	Small
Effective	+	+	+, 0, -
Not Effective	+	0	-

We can make the following statements. A negative, significant coefficient implies that the barrier (effective or not effective) is imposed against j and trade between i and m is small. A negative, significant coefficient means little, if any, diversion to m when a tariff is imposed against j. Second, an insignificant coefficient implies that the barrier is not imposed in cases where trade between i and m is large. Finally, if we are willing to rule out the possibility that trade between i and m is large (a reasonable position, since, otherwise, it would imply that a barrier was imposed against j but not m, even though trade with m was large), then a positive, significant coefficient implies that an effective barrier has been imposed against j and that trade diverts to other trading partners, m.

RESULTS

Columns 2-4 of Table 3 present coefficients for $\overline{\tau}_{ik}$, the weighted average tariff of country i, τ_{ijk}-$\overline{\tau}_{ik-j}$, the deviation of country j's tariff from the average tariff imposed against other importers, and $\overline{\tau}_{ik}$ crossed with j's exports of the good.[9] $\overline{\tau}_{ik}$ is a proxy for the aggregate price effect of tariffs imposed on HS category k. While one expects that a higher $\overline{\tau}_{ik}$ should result in substitution of purchases away from this good (and hence a negative coefficient), we know from the previous section that positive coefficients are plausible; they indicate the tariffs for this product category tend to be higher for goods in which trade is large, but the imposition does not bring trade down to a normal level. Of the nine significant coefficients for $\overline{\tau}_{ik}$ given in Table 3, five are negative. While this suggest mixed results, a closer inspection reveals an interesting perspective. All of the positive, significant coefficients are for categories that are natural resource intensive (dairy products, textile fibers, metalliferous ores, petroleum) while all of the negative, significant coefficients are in labor-intensive, capital-intensive, or chemical industries (plastic materials, non-electrical machinery, transport equipment, furniture, footwear). Unless it is the case that tariffs are higher for commodities in which trade is small (an unlikely case), we can say that, for the latter industries, high tariffs reduce trade. For natural resource intensive industries, the results indicate that high tariffs are imposed where trade is large; though we cannot

be certain as to whether the higher tariffs are effective in reducing trade.

$\tau_{ijk} - \bar{\tau}_{ik-j}$ is designed to reveal the extent to which preferential tariffs result in trade diversion. We expect trade to be diverted away from countries with the highest tariffs (and hence a negative coefficient); however, from our earlier discussion we know that positive coefficients are plausible. Nonetheless, we find the strong result that ten of the reported industries have negative, significant coefficients, while only one coefficient is positive and significant. Again, according to the framework above, unless one believes that the highest tariffs are systematically imposed against the smallest exporters, a negative, coefficient is sufficient to infer trade diversion. Nine of the ten negative coefficients fall within a reasonable range (-3.1 and -17.9) implying that a bilateral tariff 1% above other tariffs will result in a three to 18 percent decline in bilateral trade. The remaining negative coefficient (for the coal, coke and briquette sector) is over 100, reflecting a high degree of substitutability across suppliers.

TABLE 3: TARIFF AND NTB REGRESSIONS RESULTS

SITC	$\bar{\tau}$	$\tau_i - \bar{\tau}$	$EX*\bar{\tau}$	Price	Quantity	Quality	Threat
2	58.997*	0.765	1.481**	-0.71	3.944*	-2.048**	-2.243
6	-16.091	5.769*	1.445**	0.954	1.701*	3.429**	-
24	5.82	-5.323	1.094**	-0.250	0.069	0.996**	-
26	27.569**	-17.883**	1.516**	-1.026	-4.166**	-0.529*	-
28	164.656**	-6.383	1.348**	0.875	-36.406	-0.616	-
32	-63.42	-112.445**	1.236**	-5.088**	-	2.936*	-
33	19.944**	-4.923	1.588**	2.264**	-1.157	-1.519**	2.902**
58	-6.153**	-4.743**	1.302**	1.256*	3.223**	-0.491**	2.136
61	-3.920	-4.972**	1.358**	-1.435*	0.642	1.016**	-0.72
62	-3.426	-6.378**	1.351**	0.152	-0.632	-0.518*	-1.297
64	-0.029	-13.103**	1.343**	-0.082	4.281*	-0.069	-
71	-18.59**	-5.413**	1.107**	-0.937**	-1.906	0.334	-
73	-12.739**	-3.934**	1.288**	0.908	-2.543	0.298	-
82	-6.041**	-8.096**	1.266**	-3.123**	-0.6	1.176**	-
85	-8.606**	-3.137**	1.274**	0.464	-0.857**	0.68	-

**, * Significantly different from zero at the 5 and 10% level, respectively.

Our final tariff variable, $EX_{jk}*\bar{\tau}_{ik}$, yields consistent, strong results. Every coefficient is positive, significant and between 1.09 and 1.60. This implies that trade compression is present in every industry; according to our reasoning above, this suggests that variety, to the extent that it is important, is secondary to the desire to minimize the fixed costs associated with each bilateral flow. Regardless of the impact of fixed costs, this result further implies that small exporters bear the brunt of high industry tariffs.

The results for the tariff barriers are quite striking. We find strong evidence of diversionary tendencies, and strong evidence that countries wish to minimize the number of their trading partners. Finally, we find that higher tariffs are associated with low trade in a number of non-resource intensive sectors, while higher tariffs are associated with high trade in a number of resource intensive sectors.

Columns 5-8 of Table 3 presents coefficients for the NTB measures. These coefficients exhibit less uniformity than do the tariff coefficients. Nevertheless, telling patterns do arise. Among the significant coefficients for the price and quantity NTBs, a weak, but suggestive, correlation is found. There are six significant coefficients in each column, with four negative price and four positive quantity coefficients. Our reading is that quantity restrictions are more likely to raise price and hence the value of trade than are price restrictions. This relationship strikes us as very plausible. As we will see, the diversion coefficients lend additional credibility to the above assertion. As most goods are available in a wide range of varieties and qualities, when faced with a limit on the quantity that can be sold, a profit maximizing strategy would be to concentrate on the higher priced varieties.[10] This practice need not lead to a higher value of imports, but it seems likely that it would. With respect to quality and threat NTBs, we have little to say. Of the

significant quality coefficients, five are positive and five are negative. Threat NTBs are not common in our data and, hence, we are unable to generate coefficients with much precision.

We also generate coefficients designed to test for diversion resulting from the various NTBs. These are presented in columns 2-5 of Table 4. Our prior regarding the diversionary effects of NTBs is that they restrict the competitiveness of goods from the target country, benefiting those not targeted by the NTB; this implies a positive diversion coefficient. Recall from our earlier discussion, however, that a negative, significant coefficient is plausible; it simply signifies that countries against whom NTBs are not imposed tend to be partners with whom trade is small. Only three of the ten significant coefficients are positive; two are on quality and one on quantity NTBs. This is in contrast to the tariff diversion measure, $\tau_{ijk}-\overline{\tau}_{ik-j}$, which clearly shows tariff diversion effects. The negative, significant NTB diversion coefficients are not informative with regard to diversion. Not surprisingly, the negative, significant coefficients imply that NTBs tend not to be imposed against trading partners with whom trade is small. Note that we can correlate results in this table with the apparent quality upgrading in the previous table. If quality upgrading is what quantity constrained suppliers are doing, then unconstrained suppliers are increasingly pushed into lower quality, lower priced markets. This seems entirely consistent with a lower value of trade. Indeed, all but two of the ten (and three of the four significant) coefficients on the quantity diversion variable, are negative.

TABLE 4: NTB DIVERSION AND CROSSPRODUCT REGRESSION RESULTS

	Diversion				Crossproduct			
SITC	Price	Quantity	Quality	Threat	Price	Quantity	Quality	Threat
02	--	-4.683	--	--	50.186**	-37.546**	-6.382	--
06	12.082	--	--	--	-8.676*	-24.802*	-14.563**	--
24	--	--	--	--	16.474	-157.582*	-0.191	--
26	-1.505	-10.625**	-2.934	--	-19.494	2.678	20.851**	--
28	-116.093**	--	14.801*	--	--	--	--	--
32	--	--	--	--	--	--	-52.008	--
33	--	--	--	--	-16.844	1260**	-3.880	--
58	6.454	2.259	1.319	-19.650**	1.174	-10.585	7.446**	-3.667
61	-26.922*	-2.834	--	-61.844*	-10.404	-11.682**	0.589	3.031
62	4.837	-5.716	--	1.645	7.815**	19.689	0.871	97.095
64	4.863	-1.515	33.419**	--	16.797**	-21.500	8.234**	--
71	-5.634	-9.234**	2.532	--	18.753**	10.599	-5.220	--
73	20.313	15.597**	-9.749	--	-10.558*	55.736	2.511	--
82	--	-5.173**	--	--	6.141**	20.266	-8.476**	--
85	9.449	-0.587	1.037	--	6.436**	8.895**	-16.012**	1.012

**, * Significantly different from zero at the 5 and 10% level, respectively.

Our final result pertains to the ability of NTBs to substitute for tariffs. Many countries are believed to have erected nontariff barriers to trade in response to negotiated reductions in tariff barriers, but there is little evidence of the effectiveness of this strategy. Columns 6-9 of Table 4 enables a crude test of the ability of NTBs to substitute for tariffs. If tariffs and NTBs do substitute for one another, we ought to find the impact of NTBs being offset by the presence of a tariff. That is, if we cross the tariff variable with each of the four NTB variables, we ought to obtain coefficients that are opposite in sign to the simple NTB coefficients. Comparing the coefficients in Table 4 with those in Table 3, we find that of the 44 coefficients, 34 of them are of opposite sign. Of the significant coefficients, 17 of the 20 are of the predicted sign. This suggests that NTBs tend to be substitutes for tariffs.

CONCLUSION

Our study differs from prior work in that our unit of observation is at the 6-digit HS level. This wealth of information allows us to control for the importing and exporting country as well as the commodity and, unlike prior studies, we consider three separate effects for each of tariffs and NTBs. For tariffs there are the industry substitution

effects, variety substitution effects and trade compression effects, while NTBs result in direct effects, tariff-mitigating effects and diversion effects. While interpretation of signs of coefficients is problematic, we are nonetheless able to make a number of observations. Our analysis indicates a concentrating influence of higher tariffs; that is, tariffs tend to shift trade flows towards the largest exporters. We also find significant trade diversion caused by tariffs; that is, trade is diverted away from countries with the highest tariffs. Our results suggest a possible difference in the effects of general tariff levels on trade in natural resource intensive commodities versus non-resource intensive commodities. In the case of NTBs, we find that quantitative barriers are more likely to raise prices than are price restrictions. Quantity barriers also appear to lead exporters to concentrate on higher priced varieties. We do not find much evidence to suggest that countries not targeted by an NTB gain at the expense of targeted countries. We find that NTBs tend to substitute for tariffs.

By concentrating on observations at the 6-digit HS level we are able not only to control for a variety of tariff and NTB effects, but we are able to show substantial diversity of results across industries. With the exception of the coefficient on $EX_{j\kappa}*\overline{\tau}_{ik}$, the values and significance levels of the coefficients often differ substantially by industry. For the sake of comparison, we two additional regressions. The first uses a random sample from each of the 15 SITC 2-digit industries used in this study. The coefficient of $EX_{j\kappa}*\overline{\tau}_{ik}$ mirrored our earlier results. The coefficient of $\overline{\tau}_{ik}$ is negative and significant whereas it is positive and significant in 4 of the industry regressions. The coefficient of $\tau_{ijk}-\overline{\tau}_{ik-j}$ is insignificant; recall that these coefficients are negative and significant in 10 of the 15 industry regressions. Of the coefficients on the direct NTB effects, only the coefficient of QUAL is significant. In addition to pooling the data for a single regression, we also aggregated the data to the 3-digit level to mirror more closely the type of analysis conducted by previous researchers. Again, a single regression over all industries cannot suggest a diversity of effects across industries. Among the direct tariff and NTB effects, only the coefficient of QUAL is significant. This contrasts with the diversity of results from our 6-digit, multiple industry approach.

ENDNOTES

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[1] See, for example, Harrigan (1993), Trefler (1993), and Leamer (1988, 1990).

[2] The data includes information on only 30 importers. We analyze only importers that are developed.

[3] Two-digit industries can include a large number of 6-digit HS commodities. Our selection of industries was made, in part, to avoid an unmanageable number of regressors while, at the same time, allowing for a diverse set of industries.

[4] An important difference of our study from the existing literature is in the use of 3 or 4-digit aggregates in other studies; that is, unlike this study, for which the unit of observation is observed trade at the 6-digit level, the existing literature uses units of observation that are the aggregate trade observed at the 3 or 4-digit category (generally, these are SITC categories). In order to obtain sufficient sample sizes for the trade flow regressions when using such aggregates, it is necessary to combine in a single regression the observations from numerous product categories. Hence, one might find observations on the trade flow in chemicals combined in a regression with observations relating to footwear. Unfortunately, the broader the product categories used in a given regression, the greater the potential specification error due to structural differences. For example, if the efficacy of a barrier varies across types of products (for example, if the effect varies depending on the level of labor intensity), then the narrower the product categories used in a regression, the less the systematic error in the regression. While our regressions are considered for narrower product categories than other studies, systemic differences in trade flows associated with each 6-digit product category may remain; however, they are reduced compared to the potential error from studies using 3 or 4-digit aggregates.

[5] We recognize that this may induce error into our regressions if the failure to export or import is due to barriers. It may also be due to a small (or zero) scale of production or to a small (or zero) level of consumption of the good. Inclusion of zero observations in this latter case can also lead to error.

[6] "Industry Type" is from Leamer (1990), Table 13.3.

[7] These determinants would be endowments of productive resources in a traditional Heckscher-Ohlin framework, and country output in a simple monopolistically competitive framework.

[8] In a sample we studied, we found that more than 90% of the non-trade barriers are imposed against all of the products in a tariff line.

[9] All R^2 are in the narrow range 0.211 to 0.264.

[10] See Feenstra(1988) on this phenomenon in the early 1980s during the Japanese automobile VERs.

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