HOW EFFECTIVE ARE TRADE BARRIERS? AN EMPIRICAL ANALYSIS OF TRADE REDUCTION, DIVERSION, AND COMPRESSION

Jon D. Haveman, Usha Nair-Reichert, and Jerry G. Thursby*

Abstract—We analyze the effects of trade barriers using highly disaggregated data. The level of disaggregation allows us to separate the effects of tariffs and nontariff barriers (NTBs) into reduction, diversion, and compression effects. We find that multilateral tariffs significantly reduce trade flows and that trade preferences have a significant diverting effect. We also find that higher multilateral tariffs tend to shift trade towards larger exporters, suggesting that the desire to minimize fixed costs associated with trading dominates any preference for variety. In the case of NTBs, we find that, as often as not, the imposition of an NTB leads to an increase in the value of trade; in industries with low import demand elasticities, the influence of rising prices outweighs the decline in quantity.

I. Introduction

Some of the most important questions regarding barriers to international trade relate to the effectiveness of tariff and nontariff measures and their impact on multilateral and bilateral trade flows. The expected impact of measures of protection on trade flows is an integral component in investigating many issues related to protection—for example, the pattern and height of barriers to trade across industries, or the expenditure of lobbying effort by labor in search of protection. Similarly, the outcome of trade liberalization initiatives is seldom an across-the-board tariff cut; instead, it may be biased towards protective measures that provide relatively little in the way of protection for domestic industry.

In this study we analyze differences in the effectiveness of tariffs and four types of nontariff barriers (NTBs) across disaggregated industries. In the process, we identify specific distortions of bilateral trade flows that can arise from the imposition of barriers. We extend the literature on the effect of protection in several ways. First, unlike previous studies, we separate the effect of tariffs and NTBs into a reduction effect, which is a lowering of overall trade; a compression effect, which is a concentration of the source of imports into the largest exporters; and a diversion effect, which is a shift in trade patterns across exporters that is unrelated to size. This type of decomposition has policy relevance in that it permits the identification of specific channels through which protection affects trade, as well as the relative strengths (effectiveness) of these channels. Second, we use data that are more disaggregated than is typical of the literature on trade barriers. This allows for large samples, so that we can consider regressions for narrow commodity groups; this not only mitigates specification error due to structural differences in the determinants of trade flows across commodities, but it also allows for industry-by-industry comparisons of the effects of barriers.

Our analysis indicates that, in addition to the expected reduction of trade caused by barriers, there is substantial diversion of trade flows resulting from the preferential application of tariffs, and that tariffs tend to shift trade towards larger exporters. We interpret this latter effect as due to a desire to minimize a fixed cost of trading that is related to the number of countries with which an importer trades. In other words, with fixed costs, even a constant multilateral tariff can redistribute trade towards large countries; that is, trade with small exporters is sacrificed first.

In the case of NTBs, we find that the price-raising effect of an NTB frequently dominates the quantity-reducing effect, resulting in an increase in the value of trade between two countries. In addition, we

* Public Policy Institute of California, Georgia Institute of Technology, and Emory University, respectively.

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find evidence suggesting that countries not targeted by price and quantity NTBs can either gain or lose at the expense of targeted countries. We also find that the existence of a tariff tends to mitigate the price raising effects of an NTB; that is, when a tariff and an NTB are applied simultaneously, the impact more closely resembles the expected effect of the tariff alone.

II. Literature

The empirical literature addressing the effects of tariffs and NTBs on trade flows provides a wide range of results on the impact of tariffs and NTBs. Studies such as Baldwin and Lewis (1978), Cline et al. (1978), Ray (1981), Deardorff and Stern (1986), Bhagwati (1988), and Leamer (1990a) have all reported relatively small estimates of the impact of trade liberalization on imports. However, recent works by Leamer (1990b), Harrigan (1993), and Trefler (1993) report significantly larger effects of protective measures.

Leamer’s (1990a) approach is most similar to ours in that he classifies NTBs as price, quantity, quality, and threat measures. His study is the only one we are aware of that broadly addresses trade diversion, although Leamer’s diversion measure often fails to have the expected effect. Using data at the four-digit SITC level from 14 industrial countries in 1983, he finds that barriers reduced imports by about 4%, and he reports mixed results as to whether the estimated effects of NTBs are larger or smaller than tariff effects. Leamer’s (1990b) counterfactual analysis, however, finds that barriers suppress the imports of 14 importers by 20%, on average; roughly half of the suppression is due to tariff barriers and half is due to NTBs, although there are considerable differences among importers.

Trefler (1993) treated protection as endogenous, and he estimated that trade liberalization would increase imports by $49.5 billion. Results for the United States indicate that the elimination of all NTBs and tariffs in manufacturing would increase the average import penetration by 1.65 percentage points and 0.35 percentage point respectively. Harrigan (1993) uses a monopolistically competitive framework in which protection is exogenous; he finds that tariff barriers had a sizable effect in 1983 in 13 OECD countries, though he reports relatively small effects for NTBs. Tariffs had large and statistically significant results with most of the elasticities ranging between −5 and −12.

Other recent developments in the literature consider the impact of trade barriers on imports arising from the presence of fixed costs of trading. Feenstra (1992) and Romer (1994) argue that a decline in the range of goods imported could add to the costs of protection. Although tariffs by themselves reduce the profitability of importing, the presence of fixed costs of trading compounds the effect of tariffs, and could result in substantially reduced imports from some countries.2 Klenow and Rodriguez-Clare (1997) suggest that market size and tariff rates both affect the variety of goods imported. They provide evidence that in Costa Rica a 1% bigger market leads to 0.26% more variety, and that a 1% higher tariff rate results in 0.34% less intermediate-goods variety and 0.73% less consumer-goods variety. Additionally, Mayer (1999) argues that where exporting is costly and subject to economies of scale, there is a tendency to specialize in trading partners, although this may not be optimal from a welfare perspective.

While the earlier work found relatively small effects of tariffs and NTBs, later work provides evidence that the effects are in fact much larger. Using a framework similar to Harrigan’s, we find similarly large effects of protection on imports. In addition, the disaggregated nature of our data—each of our observations represents trade flows at the six-digit level, whereas most studies are based on observations at the three- or four-digit level—enables us to separate the aggregate effects of protection into reduction, diversion, and compression effects and to better illustrate the heterogeneity in the effects of both tariff and nontariff barriers. Our results are comparable with Harrigan’s; however, our work suggests that the reduction and diversion coefficients in a significant number of sectors are larger than the results reported by Harrigan. In addition, we find that higher multilateral tariffs tend to shift trade towards larger exporters, validating the assertions made by others on the influence of fixed costs to trade. As in Klenow and Rodriguez-Clare, our results are interpreted as a reduction in the number of varieties consumed.

III. Data and Empirical Specification

Our empirical specification is a regression of bilateral trade flows on determinants of those flows. The theoretical model behind this specification is a monopolistically competitive model of bilateral trade, with heterogeneity in demand and production, and incomplete specialization. We also allow the elasticity of substitution between home and foreign varieties to differ from that between foreign varieties.3 Such a framework permits us to separate the multilateral effects of protective measures from the bilateral and preferential effects.

We use the 1994 UNCTAD TRAINS data set, which is an inventory of bilateral tariffs, NTBs, and trade flows for 51 importers and 235 exporters. We limit our analysis to the 15 most developed importers and 65 most developed exporters. The data include extensive information regarding the preferential incidence of barriers, including tariffs and some 80 different varieties of NTBs.

Trade flow and barrier data are considered at the six-digit Harmonized Classification System (HS) level.4 The tariff for each six-digit category is calculated as the simple average across all tariff lines in that category. We collect the NTB varieties into four types on the basis of structure and primary effects. The NTB categories depend on whether they (1) have direct price effects (PRICE) such as minimum import pricing, trigger prices, and variable levies, (2) involve quantity restrictions (QUANT) such as quotas, seasonal prohibitions, and orderly marketing arrangements, (3) involve quality restrictions (QUAL) such as health and safety standards and technical standards, or (4) involve a threat of retaliation (THREAT) such as antidumping and countervailing duty investigations. The measure for each NTB imposed in a six-digit HS category equals 1 if any tariff line in that category is subject to an NTB, and 0 otherwise.5

With trade and barrier data on 15 importers and 65 exporters for about 5000 commodities, we can consider regressions for narrowly defined product categories.6 We identify each of the HS categories with a three-digit SIC code, which is the level at which our regressions are performed. That is, each regression includes observations on

1 For a detailed discussion of the theoretical specification behind our estimating equation, see Haveman, Nair-Reichert, and Thursby, 2000.
2 Trade flow data are only available at this level, whereas barrier data are available at the eight- or ten-digit level.
3 This approach appears reasonable in that we found in a sample of product categories that a majority (more than 90%) of NTBs are imposed against all tariff lines for a single HS category.
4 The 15 importers are Australia, Austria, Canada, the European Union, Finland, Hong Kong, Japan, South Korea, New Zealand, Norway, South Africa, Sweden, Switzerland, Taiwan, and the United States. Among the 65 exporters, we have both developed and developing countries.

5 When there are fixed costs of selling in a country, goods will be imported only if profits are large enough to cover these fixed costs.
bilateral trade at the six-digit level spanned by a particular three-digit SIC group. For example, there are 21 six-digit HS codes that map into SIC 227, carpets and rugs; thus the carpets-and-rugs regression includes 21 commodity flows and barriers for each importer and exporter pair.

The estimating equation takes the form

\[
\ln M_{ij}^k = \alpha + \delta_i E_i + \alpha_M M_i + \kappa_i H_i + \beta_i DIST_{ij} + \beta_i BORDER_{ij} + \beta_{11} \text{LANG}_{ij} + \delta_1 \ln TAR_i + \delta_2 \ln TARD_{ij} + \delta_3 \ln TARComp_{ij} + \sum_k \chi_{k3} NTB_{ij}^k + \chi_{k4} NTBDiv_{ij}^k + \chi_{k5} NTBComp_{ij}^k + \chi_{k6} TAR_i + \chi_{k7} TAR_{ij} + \varepsilon_{ij}^k
\]

The first line includes a constant, exporter \((E)\), importer \((M)\), and commodity \((H)\) dummies, and the country-pair variables. Tariff variables are on the second line and reflect reduction, diversion, and compression effects, respectively. The third line includes the NTB variables, where \(t\) runs over NTB types-price, quantity, quality, and threat. For each NTB type, there are variables that reflect reduction, diversion, and compression effects. The first term in the fourth line is the interaction of NTB and tariff variables and \(\varepsilon_{ij}^k\) is a random disturbance.

A. Trade Flow Data

A trade flow observation, \(M_{ij}^k\), is the dollar value of bilateral imports for individual country pairs \(i\) and \(j\) for a particular six-digit HS code \(k\). For most country pairs the trade flow is zero; thus we augment the data with zero flow observations. As some zero observations are the result of trade barriers, the inclusion of zero flow observations avoids bias and inconsistency induced when such 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. We recognize that such omissions may introduce error if the failure to export or import is due to barriers. However, the lack of trade may also be due to a small (or zero) scale of production or level of consumption; in such cases, the inclusion of zero observations can lead to error. Our prior is that the latter case is more common and the omission of these observations is appropriate. However, as a precaution we estimated all equations including all zero flow observations and found results that are qualitatively the same. The detailed results in the next section are based on regressions that exclude those observations.

B. Trade-Barrier Data

We incorporate in our regression both NTB and tariff effects. There are three separate effects (reduction, diversion, and compression) for tariffs and each of the four NTB types. The trade-reducing effect, \(TAR^k\), is calculated as a trade-weighted average of the bilateral tariffs imposed by country \(i\) in HS category \(k\). This variable reflects changes in a price index of imported varieties relative to the domestic price level, and an increase will reduce imports as consumers substitute domestic for foreign varieties. The weights are each country’s multilateral exports at the five-digit HS level; this weighting scheme is chosen to reduce the bias due to simultaneity that would result from using six-digit imports as weights. The tariff diversion effect, \(TARDiv^k\), reflects variability in tariffs across countries and captures the extent to which preferential tariffs lead to diversion from one variety of the good (defined by country of origin) to another. We calculate this variable for each exporter as the difference between the tariff it faces on that commodity and the average tariff faced by all other exporters. The effect is expected to be negative: a high relative tariff diverts trade away from a particular exporter.

The third tariff effect arises from the presence of fixed costs, which can lead to a compression of trade into fewer partners than would be observed in the absence of barriers. We expect the existence of fixed costs to increase the extent to which countries import from large potential suppliers by diverting trade away from smaller suppliers (or, alternatively, we expect a smaller tariff reduction effect in the case of exporters who are larger than average). The compression effect is measured by \(TARComp^k\), which is the product of \(TAR^k\) and the exporter’s export potential, measured as that country’s exports at the three-digit SIC level. Note that the raw coefficient on \(TAR^k\) must now be modified if it is to maintain its original interpretation. That is, the compression effect operating on a country with the mean exporter potential must be added onto the raw \(TAR^k\) coefficient. The adjusted coefficient is reported throughout the results section. The reported coefficient on \(TARComp^k\) is then the change in the trade compression effect that results from differences in size across exporters.

For each of the four NTB types-price, quantity, quality, and threat-the reduction effect, \(NTB^k\), is a trade-weighted (using exports at the five-digit HS level) NTB coverage ratio for NTB type \(t\) imposed by country \(i\) on commodity \(k\). Although higher tariffs lower both the volume and the value of trade, an NTB can increase or decrease the value of trade, depending on domestic elasticities. Hence, the sign of the \(NTB^k\) coefficient depends on these elasticities, with both positive and negative coefficients to be expected: negative when the quantity effect dominates the price effect, and positive otherwise. The diversion effect, \(NTBDiv^k\), indicates the extent to which an NTB diverts trade from exporters facing the NTB towards unencumbered exporters. For countries exempt from the NTB, this variable is positive and equal to the proportion of trade from exporters facing the NTB towards unencumbered exporters. For countries exempt from the NTB, this variable is positive and equal to the proportion of countries covered by the NTB, and for constrained exporters it is negative and equal to the proportion of countries exempt from coverage. Positive values for this variable indicate relative advantage, and negative values indicate relative disadvantage; our prior is that advantaged countries will experience an increase in bilateral trade and hence the coefficient will be positive.

The NTB compression effect, \(NTBComp^k\), is defined similarly to the tariff compression effect. That is, it is the product of \(NTB^k\) and the exporter’s export potential, measured as that country’s exports at the three-digit SIC level.

Finally, we include what we call the NTB-mitigating effect of a tariff, which arises from the coincident application of a tariff and an NTB. The variable capturing this effect, \(TAR^k \cdot NTB^k\), is expected to have an effect opposite in sign to the coefficient estimate on the NTB variable. The imposition of a tariff lowers the value of trade, and the imposition of a quota in the same industry can raise or lower the value of trade in the absence of a tariff. In the event that both a tariff and a quota are applied in a perfectly competitive industry, the effect would mirror that of the tariff, lowering the value of trade relative to that resulting from the lone application of an NTB.

C. Country-Pair and Other Effects

There is little question that various relationships, quite apart from economic differences between countries, can influence trade between country pairs. Rather than attempt to incorporate country-pair dummies, we include some of the more popular measures from the gravity
equation literature, to which our framework is related. Country-pair characteristics include the distance between major economic centers in the two countries (DIST$_{ij}$), whether or not a common land border is shared (BORDER$_{ij}$), and whether or not a common language is spoken (LANG$_{ij}$).

D. Econometric Problems

Since the data contain a large number of zero values for the dependent variable, we use a standard tobit estimator. The existence of simultaneous-equation bias in a framework such as ours has been widely discussed. In our regression the potential for simultaneity arises from two sources. First, there is the endogenous-protection argument that, though protection is directed at reducing imports, high levels of imports are a cause of protection; we do not correct for this endogeneity because of a lack of reasonable instruments at the level of disaggregation we use. Second, the use of trade flows to construct average levels of barriers can introduce simultaneity. In our calculations we use exports at the five-digit level to weight tariff variables at the six-digit level. By this means, trade weighting as a source of bias arises from two sources. First, there is the endogenous-protection argument that, though protection is directed at reducing imports, high levels of imports reduce trade, they compress trade into larger potential exports, and tariff preferences result in significant trade diversion. 8 What is striking is that the tariff coefficients are large. We find that the demand for imports is on average very elastic, with a mean (for all coefficients) of 4.85 and inconsistency is reduced, though not eliminated, as the left-hand side of the regression is only a small part of the trade weight on the right-hand side.

IV. Results

We estimate the parameters in our equation separately for 158 three-digit SIC industries. 7 For the sake of brevity we do not present all results; rather, we present in table 1 a summary of the distribution of results. On average, there are 14,802 observations in each regression, about three-quarters of which are zeros. We also explain, on average, 24% of the observed variability of trade flows.

The leftmost column of table 1 lists trade effects, and the middle columns give the distribution of the coefficients that are significantly different from zero at the 5% level. The rightmost four columns give the number of coefficients estimated (All/Count), the mean of those coefficients (All/Mean), the share of the total count that are significant (Significant/Share), and the mean of the significant coefficients (Significant/Mean). We do not present the distribution of all coefficients (that is, insignificant as well as significant coefficients), for that distribution is similar to the distribution of significant coefficients (although it has greater variability and a higher concentration around zero).

In general, the results for the tariff variables indicate that high average tariffs reduce trade, they compress trade into larger potential exporters, and tariff preferences result in significant trade diversion. Note that although most of the reduction and diversion coefficients either are insignificant or have the expected negative (and significant) signs, there are cases of positive, significant effects. 9 What is striking is that the tariff coefficients are large. We find that the demand for imports is on average very elastic, with a mean (for all coefficients) of

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7 For several reasons some coefficients could not be estimated for each of the 158 industries. On occasion we encountered perfect multicollinearity.

8 As discussed in Haveman, Nair-Reichert, and Thursby (2000), these results need not be considered anomalous.
5.4, whereas the mean for diversion is 8.1. This corresponds to an elasticity of substitution of 5.4 between home and foreign varieties and 8.1 between foreign varieties. A greater degree of substitution between foreign varieties than between home and foreign suggests a significant home bias, perhaps because domestically produced varieties more closely approximate the ideal variety. This relationship holds generally true for industry-by-industry comparisons as well as for the means. In table 1, we include a row that shows the differences in the diversion and reduction coefficients (Div-Red). The diversion coefficient is negative and significantly less that the reduction coefficient in 57 out of 141 industries (it is insignificant in all other cases). Further, when the difference is significant, the elasticity of substitution between foreign goods exceeds the elasticity of substitution between home and foreign varieties by 19.1 percentage points on average. This suggests a tremendous potential for trade diversion due to the preferential application of tariffs.

Before turning to the NTB effects, we note that their results should be viewed with caution for several reasons. First, there may be substantial measurement error in the NTB measures; according to UNCTAD sources, what is considered to be an NTB is often at the discretion of UNCTAD staff. Second, the number of coefficients we estimate is often much smaller than the number of tariff effects estimated, and, even when we are able to estimate NTB coefficients, the results are often based on very few NTBs.

Unlike the tariff reduction measures, we do not have strong priors for the coefficients on the NTB variables. However, we can still learn from their distribution. Price and threat variables each have roughly equal numbers of significant positive and significant negative coefficients, whereas the quality effects are more frequently negative and the quantity effect is positive in about two-thirds of the cases. As noted above, the sign of these coefficients depends on import demand elasticities; positive coefficients can occur for industries with particularly low demand elasticities, so that the price effect dominates the quantity effect. We can examine this hypothesis by comparing the signs on the NTB reduction coefficients with those for the tariff-NTB interaction term (\( TAR_i \times NTB_k \)). If the hypothesis is correct, then the two coefficients should be of opposite sign. For NTB reduction coefficients with positive signs, the coefficient of \( TAR_i \times NTB_k \) should be negative; in this case, the tariff eliminates the price effect, leaving only the quantity effect on the value of trade. Likewise, a negative coefficient should be paired with a positive coefficient on \( TAR_i \times NTB_k \); here, the quantity effect is accounted for by the tariff and the positive coefficient will prevent double counting. We find this relationship in about 67% of all cases, and in 93% of the cases where both coefficients are significant.

Turning to the NTB diversion effects, we find that when price or quantity restrictions are applied selectively, there appears to be a positive impact on countries not covered by the NTB. In the case of price NTBs, there is a positive trade diversion effect in 12 of 14 significant cases. Similarly, a positive diversionary impact is recorded for 28 out of 31 significant quantity NTBs. This positive relationship indicates that unencumbered exporters gain from their preferential status. Threat diversion effects are nearly equally divided between positive and negative coefficients, whereas preferential quality NTBs, twice as often as not, yield a negative coefficient. This negative relationship, when observed, suggests that the quality upgrading of countries facing the NTB generally reduces the export opportunities for unencumbered countries to low-quality varieties. As the price of these varieties will naturally be lower, the value of the bilateral trade flow may actually fall for unencumbered exporters.

Finally, there is evidence of trade compression arising from NTBs, in particular for quality NTBs, as positive coefficients outnumber negative coefficients by almost 5 to 1, and 76 of the 118 significant coefficients are positive. At the same time, however, the estimated coefficients are generally very close to zero, so any compressing effect is likely to be small.

Before ending this section we note that we did consider a number of alternative regression models in order to assess the sensitivity of our results to changes in the model or data. First, we noted earlier that we excluded any zero flow where the exporter does not export the good to any country, or the importer does not import the good from any country. This could introduce bias if zero trade is due to trade restrictions. On the other hand, zero flows could be due to a very small scale of production or level of consumption. We reran all regressions including all zero flows, and found results that are qualitatively the same. Quantitatively, the coefficients tend to be larger, though less precisely estimated. Second, it was suggested to us by a referee that our use of country dummy variables rather than importer and exporter incomes might lead to the compression variable picking up some of the income effects. We reran all regressions using incomes in the place of country dummy variables. Our results are strengthened somewhat in that coefficients are generally larger in absolute value and there are more significant coefficients. In particular, the compression coefficients are larger and the NTB variables show more clearly compression effects. Finally, instead of separating NTBs into four categories we aggregated them into a single category. The coefficients in this case look much like the quantity NTB coefficients in the regression with four NTB categories. Otherwise the results are essentially unchanged except that the tariff diversion effects are larger.

In this section, we have shown that, although tariffs and NTBs have generally predictable effects, there is significant variability in the magnitude of effects. Some tariffs reduce trade by a lot, some preferences divert trade more than others, and some NTBs raise the value of bilateral trade whereas comparable NTBs in different industries lower the bilateral value of trade.

V. Conclusion

Successive rounds of GATT negotiations have focused on the reduction of tariff and nontariff barriers to international trade. This study provides the first comprehensive analysis of the extent to which bilateral trade patterns are influenced by differential rates of protection across industries and countries. It is unique in that it employs data at the six-digit HS code level—significantly more disaggregated than is commonly found in this literature. Thus, this study is able to highlight the significant diversity in the effectiveness of tariff and nontariff barriers across industries.

The results presented in section IV extend the literature in several ways. Not only is the empirical analysis focused on disaggregated industries, but this disaggregation permits decomposition of the effects of tariffs and NTBs into reduction, diversion, and compression effects. Whereas diversion has been studied empirically by Leamer (1990a), the compression effect represents an innovation in the analysis of trade distortions. This type of decomposition has policy relevance in that it permits the identification of specific channels through which protection affects the magnitude of trade, as well as the relative strengths (effectiveness) of these channels.

We find the trade-reducing effects of barriers to be quite large. Based on different approaches and different levels of data aggrega-
tion, Trefler (1993) and Harrigan (1993) also found sizable effects of trade barriers. Trefler finds sizable NTB effects, but much more modest tariff effects, whereas Harrigan finds sizable tariff effects and small NTB effects. We find sizable tariff effects and generally sizable NTB effects. We conducted a counterfactual analysis that suggests that tariffs, at their 1993 levels, served to reduce trade flows by 5.5% on average in our 15-country sample of importers. In some countries this reduction effect was as high as 13%. Our analysis also permits us to highlight the magnitude of the trade-distorting effects of NTBs. Because NTBs can either raise or lower the value of trade, we found that the net trade-reducing effect was only 0.4%, despite the fact that they distorted trade flows by more than 8% on average, with significantly higher distortions in some countries. Our results indicate that trade diversion is significant. Preferentially reducing a barrier generally results in a greater increase in trade with the preferred country than would result from a reduction in the multilateral tariff, and this differential is often quite large. Our results also suggest a significant home bias in many industries; that is, the elasticity of substitution is greater between foreign varieties than it is between domestic production and imports. Furthermore, it calls into question the extent to which domestic producers receive relief from the maintenance of barriers against only a subset of exporters.

We also provide evidence of the trade-compressing effects of tariffs that result from the presence of country-specific fixed costs of trading. As the average multilateral tariff rises, the trade-compressing effect falls disproportionately on smaller potential exporters. This is important not only because it helps us understand the effects of trade barriers, but because it provides potential insight into the behavior of some exporters. Notably, some developing countries have adopted the strategy of exporting a variety of products from a small number of industries, rather than diversifying the product space spanned by their exports. While there are many other reasons countries might pursue this strategy, our results suggest that this makes them large exporters in a small number of sectors, rather than small exporters in a large number of sectors. As such, they will be less likely to be on the short end of the compression stick.

NOTES


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REFERENCES

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UNIVERSITIES AS RESEARCH PARTNERS

Bronwyn H. Hall, Albert N. Link, and John T. Scott*

Abstract—Universities are a key institution in the U.S. innovation system, and an important aspect of their involvement is the role they play in public-private partnerships. This note offers insights into the performance of industry-university research partnerships, using a survey of precommercial research projects funded by the Advanced Technology Program. Although results must be interpreted cautiously because of the small size of the sample, the study finds that projects with university involvement tend to be in areas involving new science and therefore experience more difficulty and delay, yet are more likely not to be aborted prematurely. Our interpretation is that universities are contributing to basic research awareness and insight among the partners in ATP-funded projects.

I. Introduction

Many observers have emphasized the importance of research partnerships for U.S. innovative capacity (Council on Competitiveness, 1996, pp. 3–4). Indeed, industry-university research relationships appear to have strengthened over the past few decades. University participation in formal research joint ventures (RJVs) has increased steadily since the mid-1980s (Link, 1996), and the number of industry-university R&D centers increased by more than 60% during the 1980s. Cohen et al. (1997) and a recent survey of U.S. science faculty revealed

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* University of California at Berkeley and NBER, University of North Carolina at Greensboro, and Dartmouth College, respectively.

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