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Abstract

As multilateral negotiations focus more on reductions and removal of non-tariff barriers (NTBs), the importance of quantifying the impact of these barriers has increased. Recent studies have derived *ad valorem* equivalents for NTBs for a large number of countries and/or products, but the derivation has been indirect, due to either lack of price data or NTB incidence measures. This paper uses city level retail price data to *directly* estimate the average impact of core NTBs on prices of 47 consumer products, grouped into four separate sectors, for more than 60 countries in 2001. The analysis uses both government self-reported data and a new database of private sector complaint data to assess NTB incidence. A differentiated products model is used to capture imperfect substitutability between products. With city level price data-- including both inter- and intra-country price differences—a more precise distinction can be made between the impact of NTBs and the impact of local distribution costs in raising price. The model is estimated using an instrumental variables approach to incorporate the endogeneity of NTBs. Results suggest that core NTBs are still highly restrictive in many countries and for many traded goods. While NTBs appear to be complements to tariffs, in some sectors the presence of a tariff reduces the price impact of the NTB. Results also suggest that in some sectors, the restrictiveness of NTBs is highly correlated with country income.

1. Introduction

With the steady decrease in worldwide tariffs accomplished in the various rounds of multilateral trade negotiations over the past several decades, the attention of both policymakers and economists has turned to the role of non-tariff barriers (NTBs).[1] NTBs represent a major challenge for the multilateral trading system both because they are difficult to negotiate and because they threaten to undermine the tariff commitments already made. The complicating factor has always been the informational burden of identifying NTBs and quantifying them in a common and economically meaningful way. Considerable progress has been made on the identification front: UNCTAD has cataloged hundreds NTBs by type, country and product since the 1960s, for example. Yet quantification has proven elusive. This paper offers a new method for quantifying NTBs, which is designed to be of particular use to policymakers. Its main virtue is in estimating the price effects of known NTBs econometrically, using price data for many products in many countries, and NTB incidence data. This yields direct estimates of the impact of known NTBs, as well as standard errors for testing their significance. It also overcomes several measurement issues, such as product differentiation, that have long plagued other price-based methods.

For a method of NTB quantification to be of use to negotiators, it must isolate the effects of the specific policies being negotiated or considered for negotiation. Policymakers acknowledge that non-tariff measures vary by type, effects, and objectives. While some non-tariff measures may serve legitimate purposes, others may simply be barriers that reduce market access. Doha draft procedures for dispute resolution, for example, require a country to identify the specific NTB under dispute, and provide detailed information on that NTB's impact on trade (WTO, 2008). To accomplish this, negotiators would require information on the price impacts and/or trade-reducing effects of specific NTBs imposed on specific products by individual partner countries.[2]

The literature on measuring NTBs features two main methodological approaches (see Deardorff and Stern, 1998, and Ferrantino, 2006, for surveys). One is to estimate econometrically the effects of NTBs on markets, conditional on

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[1] In previous versions of this paper we have used the alternative term "non-tariff measure" (NTM), to focus on the economic effect of the measure in question on international transactions rather than on its legal status or non-trade motivations. However the terms are often used interchangeably and "non-tariff barrier" (NTB) is more commonly used in the academic literature.

[2] Recent UNCTAD Experts Meetings on NTBs provided a forum for researchers and policymakers to clarify methodological, classification and technical issues related to NTB quantification, to better understand the impacts of NTBs--especially for LDCs (UNCTAD, 2005).

information about their incidence. This is approach taken here.[3] The other approach is to infer the presence of *implicit* NTBs from anomalies in the market data, such as unexplained "price gaps" (i.e., differences between domestic and foreign prices) or smaller-than-predicted trade flows.[4] Both are perfectly valid approaches (albeit each with its own set of issues), but they answer different questions. The first answers the policymaker's question about isolating the affects of known policies, while relying on other sources of information to identify the policies themselves. The second helps to identify barriers that may otherwise be hidden. This too is valuable; however, unless these hidden barriers can be linked to specific policies, it is unclear how a policymaker would tackle them.

Although our study departs from the price-gap literature in methodology, we do confront many of the same measurement issues when attempting to estimate the effect of NTBs on prices. The foundational study by Deardorff and Stern (1998) gives a detailed exposition of the calculation of the tariff-equivalent of NTBs using data on individual product prices, and allows for different types of NTBs, market competition, and product substitutability. Ferrantino (2006, p. 6) notes that, "[T]his method requires a good deal of fairly precise information on prices, transport and distribution costs, tariffs, taxes, and/or subsidies at the product-specific level, and in some cases information on quality differences between products." Unfortunately, this amount of cross-product, cross-country data is not usually available.

Two recent studies have surmounted some of these problems, to yield cross-product, cross-country measures of implicit NTBs. Bradford (2003, 2005) calculates the levels of *ad valorem equivalent* (AVE) of trade protection generated by tariffs and NTBs combined, for a number of imported products and eight OECD countries. Using retail price data from the OECD, domestic transport and retail margins from input-output (I-O) tables, and international transport costs from reported c.i.f./f.o.b. ratios, he derives proxies for export prices for a large number of products. If the ratio of a country's price to the minimum export price in the sample exceeds one, that premium is assumed to reflect the aggregate effect of a country's trade protection on the price of a good. The implicit NTB is

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[3] We focus on the *price* effects of core NTBs (i.e., import quotas, prohibitions, import licenses, and export restraints, see WTO 2001) across countries and products, whereas most focus on *trade flow* effects of core NTBs, e.g., Leamer (1987), Trefler (1993) and Kee et al. (2006). Numerous studies examine the effects of individual NTBs on particular sectors and countries. See Deardorff and Stern (1998).

[4] Early examples of the price gap method include Baldwin (1975) and Bhagwati and Srinivasan (1975), and more recently, Bradford (2003, 2005). Saxonhouse and Stern (1989) use the trade flow method to examine claims about implicit NTBs in Japan. This is related to the now voluminous literature on border effects, pioneered by McCallum (1995).

inferred indirectly, as the difference between the AVE of aggregate trade protection and the tariff.

Bradford's implicit NTB measure captures not just known NTBs but any other factor not included in the accounting, whether policy-related or not. One limitation of this method (quite apart from the question of whether implicit NTBs are useful to policymakers) is that any measurement error in margins or transport costs translates directly into error in the implicit NTBs. This is especially problematic considering that c.i.f./f.o.b. ratios have been found to be badly error-ridden in levels (Hummels and Lugovskyy, 2006). A second limitation is that without accounting for NTB incidence, the researcher cannot distinguish the impact of known NTBs *from* other forces which contribute to price gaps. In addition, without standard errors, there is no way to judge the significance of known NTBs in explaining the price gap. Finally, while care is taken to use data on comparable products, some of the AVE attributed to NTBs using this methodology could represent price premia due to product differentiation.

Like us, Kee et al. (2006) (KNO) use econometric methods to estimate the AVEs of non-tariff barriers. KNO provide estimates for a much larger group of developed and developing countries than Bradford, and use much more finely defined product level data. KNO also use explicit data on NTB incidence from the UNCTAD TRAINS database, and provide separate estimates for price effects of core NTBs and for domestic price support. Thus, the KNO results come closer to meeting policymakers' requests for impacts of specific barriers (UNCTAD 2005). However, unlike Bradford, KNO do not have price data. Recognizing that NTBs are often endogenously determined, KNO use a Heckman two-stage procedure to first explain the incidence of NTBs,[5] and then estimate the impact of NTBs on trade flows, using a specification based on the Heckscher-Ohlin trade model. These quantity effects are then translated into price effects using their own separately estimated import demand elasticities (Kee et al., forthcoming). KNO's approach has the advantage of using very detailed NTB incidence data at the tariff line level, and of distinguishing between homogeneous and differentiated products when estimating elasticities. However, the lack of price data still leaves KNO with indirect estimates of the AVE of NTBs. These indirect estimates are dependent upon the ability of the Heckscher-Ohlin model specification to explain trade flows,[6] as well as the reliability of the separate elasticity estimates.

In this paper, we combine the strengths of both Bradford and KNO, by estimating price effects of core NTBs econometrically, using price data for many products in many countries, and NTB incidence data. This yields direct estimates

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[5] NTBs include price and quantity control measures, and domestic agricultural price supports.
[6] Leamer (1988) provides extensive evidence and discussion of the difficulties of using trade flow data and trade models to indirectly infer the impact of trade barriers.

of the impact of NTBs, as well as standard errors for testing their significance. To obtain a more thorough assessment of the extent of NTBs across countries and products, we use data on incidence drawn from two complementary databases: the UNCTAD TRAINS database and a new NTB database compiled by the USITC which documents private sector complaints about NTBs. To address imperfect substitutability, we specify the direct relationship between NTBs and prices using a simple differentiated product model. This model captures the fact that the retail price in a particular location will likely be an average of the retail prices of all the imported and domestic varieties sold locally, and that these products are likely to be differentiated by source.

We estimate this model using city-level retail price data for 47 products from about 115 cities from the EIU CityData for 2001.[7] These city-level price data allow us to examine both inter- and intra-country price differences and illustrate the general principle that deviations from purchasing power parity (PPP) are widespread, as well as the fact that these differences are product-specific and country-specific.[8] Our estimation strategy is designed to distinguish the effects of NTBs from other systematic sources of deviation from PPP, such as transport and local distribution costs.[9] Finally, we correct for potential endogeneity of NTBs, following the endogenous treatment variable literature. In the first stage we explain the existence of NTBs using an instrument based on the political economy literature. In the second stage, this estimate is used as a proxy for the NTB and its interactions with other variables, to produce country-specific effects of NTBs on prices.

The estimation yields both cross-country averages and country-specific estimates of the effects of core NTBs, for more than 60 countries and four sectors in which NTB protection was of major importance: fruits and vegetables, bovine meats, processed food, and apparel. Country-specific NTB premia for bovine meat are the highest on average, followed by apparel, fruits and vegetables, and processed foods. Four key findings emerge. First, results support the claim that NTBs are endogenous. We also find evidence that NTBs and tariffs are complements—NTBs are more likely the higher the tariff protection on a product. Second, controlling for the interaction of barriers is important. In some sectors, the joint use of a tariff and an NTB reduces the impact of the NTB on product price. Third, controlling for the interaction between income and NTBs also

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[7] See http://www.eiu.com/site_info.asp?info_name=ps_cityData&entry1=psNav&page=noads.

[8] For some stylized facts on the characteristics of EIU CityData, see Hufbauer, Warren and Wada (2002).

[9] As will be apparent, our model implicitly treats imported retail goods as being produced by a combination of foreign-produced goods plus transport and distribution services. The goods as produced *ex factory* or *ex farm* in the exporting country can be thought of as "middle products" in the sense of Sanyal and Jones (1982).

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matters. While it is commonly thought that richer countries have more open markets than poorer countries, evidence for these four sectors suggests that the restrictiveness of NTBs may fall or rise as country income rises. Fourth, the use of private sector complaint data to augment government self-reported NTB incidence does appear to significantly affect the estimates of the restrictiveness of NTBs.

2. The Incidence of NTBs

To assess the incidence of NTBs globally, we collected information from two datasets: UNCTAD TRAINS (using WITS) and a new database compiled by the ITC (Donnelly and Manifold, 2005). Data for TRAINS are collected from publicly available sources, such as official government documents, and other commercially available publications, and are reported in detail at the tariff line level. In contrast, the ITC database is constructed largely from the EU's Market Access Database and the USTR *National Trade Estimate Report on Foreign Trade Barriers,* with additional information from the WTO's *Trade Policy Reviews.*[10] The first two sources document complaints from the EU and US private sector, respectively, about impediments to trade in other countries. Hence, the data are less detailed and often reported in terms of broad product categories or broad types of restraints.

We focus on core NTBs only, such as import quotas, prohibitions, import licenses, and VERs.[11] While the TRAINS and ITC measures are chosen to reflect similar types of NTBs, the databases are likely to reflect different, and potentially complementary, information. TRAINS includes a much more finely defined list of NTBs, so is likely to be more comprehensive than the ITC database. However, if some of these NTBs have no binding effect, the TRAINS database will overstate the incidence of significant NTBs. In contrast, the ITC database largely records an NTB only if there is a complaint about it by the EU or US private sector. This may yield a better sense of the NTBs which are actually binding. However, it may understate NTB incidence because: it omits any complaints about EU or US NTBs by other countries; it does not generally include NTBs which do not elicit complaints. Of course, exporters who are not competitive in a particular market have an incentive to overstate the restrictiveness of foreign trade barriers.[12] This is unlikely to bias the count of

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[10] EU's Market Access Database (http://mkaccdb.eu.int); USTR's National Trade Estimate Reports
(http://www.ustr.gov/Document_Library/Reports_Publications/2002/2002_NTE_Report/Section_Index.html); WTO's Trade Policy Reviews (http://www.wto.org/english/tratop_e/tpr_e/tpr_e.htm).
[11] The Quantity Control Measures designated as 6100-6900 in the TRAINS database, in WITS.
[12] We thank an anonymous referee for emphasizing this point.

core NTBs, because they are imposed through explicit policies. But it could contribute to an upward bias in the count of local practices, safety standards, customs procedures, etc., that behave *ex post* as NTBs.

| ITC Core NTB Incidence	TRAINS Core NTB Incidence	
	Yes	No
Yes	199	453
No	1314	3128

Figures 1a and 1b compare core NTB incidence, as recorded in the TRAINS and ITC databases, across 50 of the countries and 102 of the consumer goods in the EIU CityData, respectively.[13] Whether incidence is examined across countries or across products, both databases show core NTBs to be widespread. Of the 5094 product-country pair observations,[14] both databases agree on NTB incidence for more than half the specific pairs. But TRAINS (ITC) records NTBs on an additional 1314 (453) specific pairs which the ITC (TRAINS) database does not. As anticipated, TRAINS records many more NTBs than the ITC database. In figure 1a, the two distributions of NTBs across countries show a negative correlation (-0.16), while in figure 1b, the two distributions across products show a small positive correlation (0.30).

This evidence suggests that despite significant overlap, the two databases may supply a considerable amount of independent information. In particular, the 453 cases where the ITC database records NTBs, and TRAINS does not, may indicate barriers which are not officially recorded, but still impede trade. There are four countries—Ecuador, Israel, Mexico and Turkey—for which barriers are recorded on additional products: most meats, alcoholic beverages, and apparel products. There are also four product groups, for which barriers are recorded for additional countries: most apparel products entering Japan, Russia, Eastern Europe, Columbia, Venezuela, and Paraguay; most alcoholic beverages entering the Philippines and Viet Nam; most meat products entering China, Iceland, Nigeria, and Pakistan; many fruits and vegetables entering the EU, Japan, Malaysia, and Singapore. To compile the most comprehensive assessment of incidence, without presuming which barriers are binding constraints, we work with the union of the TRAINS and ITC databases. We then consider how the additional information from the ITC database impacts our results.

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[13] The EU is treated as a single country in these figures. Appendix I shows the list of products and corresponding HS 6-digit or HS 4-digit codes. Appendix II shows the list of countries.

[14] The figures include only country-product observations where both databases have records. The ITC database omits Bahrain, Cote d'Ivoire, Jordan, Peru, Saudi Arabia, Senegal, and Sri Lanka. TRAINS omits Azerbaijan.

Figure 1a. NTB Incidence by Country, 2001
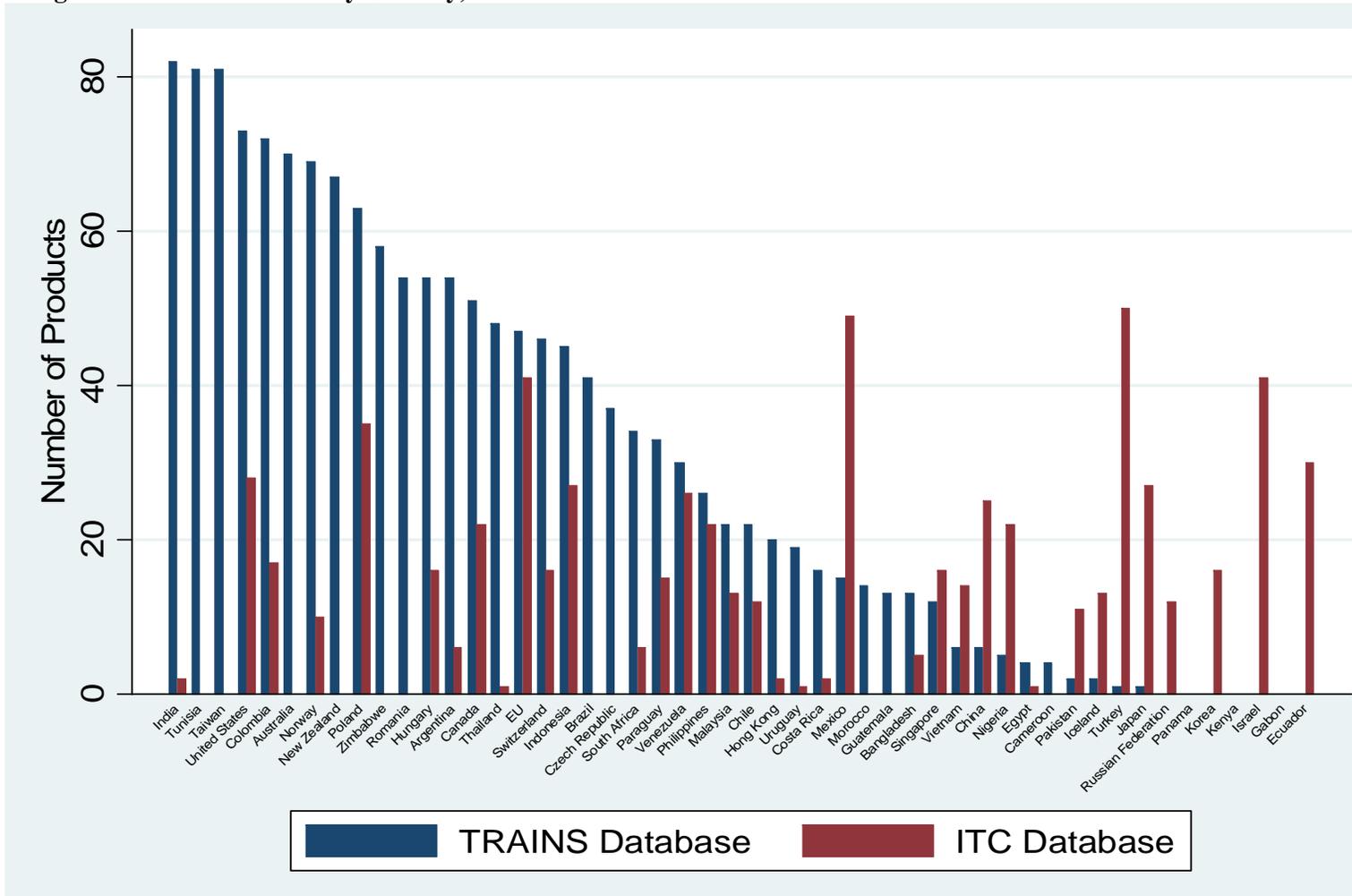
Figure 1b. NTB Incidence by Product, 2001
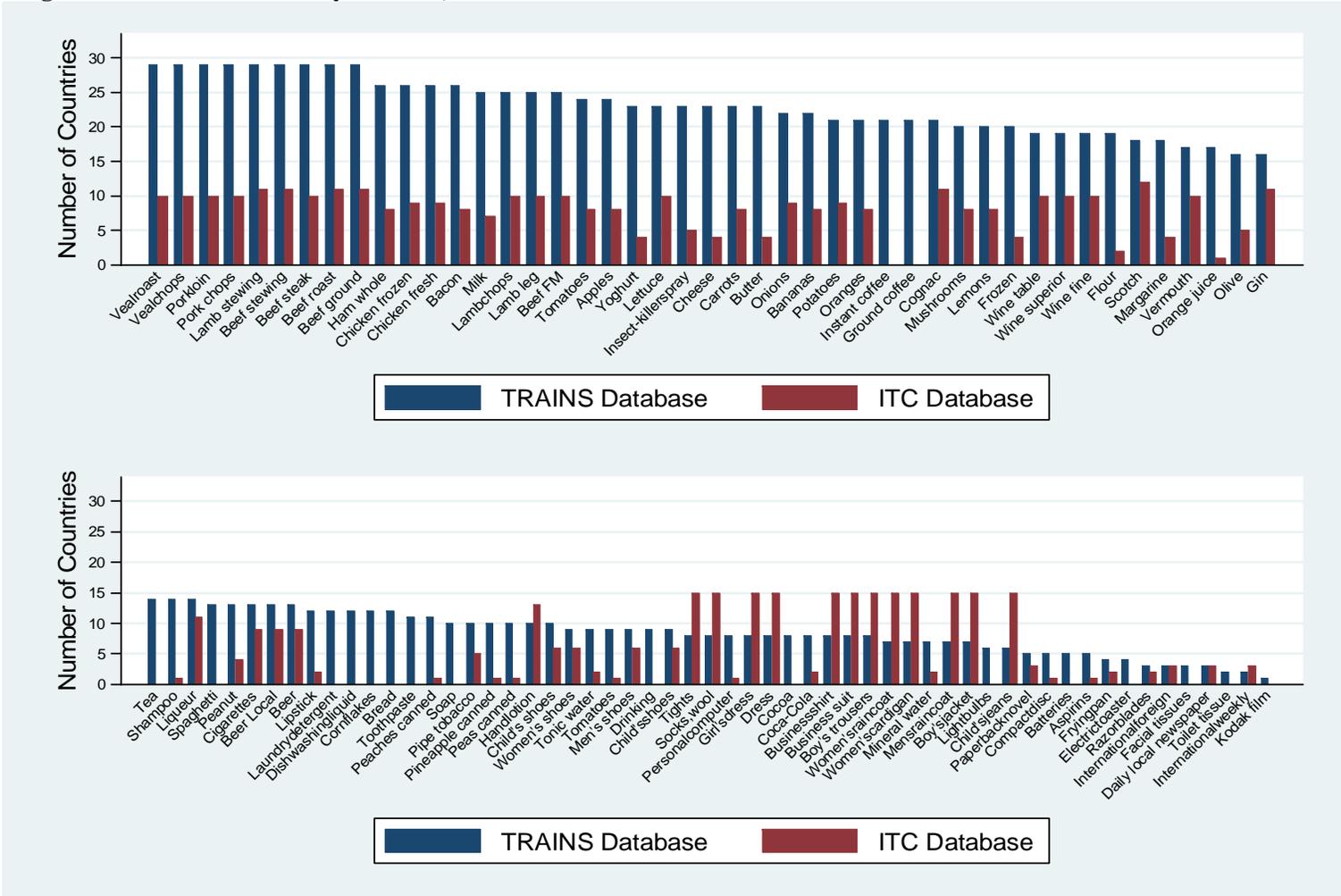
3. Conceptual Framework

As noted by Deardorff and Stern (1998), isolating the impact of an NTB policy on the price of any good *x* is difficult when the only data available are the home and foreign country retail price of *imported x*. Even if we consider a very simple scenario, several issues arise. For example, suppose we consider the case where one country has imposed a core NTB (e.g., an import quota) on one homogenous good, and apart from tariffs, no other distortions exist. The specific NTB rent (q) will be the retail price gap between home country *i* and foreign country *i**, $(P_i^{Rm} - P_{i*}^{Rm})$, adjusted for differences in local distribution markups (μ), all transport costs (d), and specific tariffs (t):

$$q_i = (P_i^{Rm} - P_{i*}^{Rm}) - (\mu_i^m - \mu_{i*}^m) - (d_i^m - d_{i*}^m) - (t_i^m - t_{i*}^m), \tag{1}$$

where superscript *m* indicates the *import* good.[15]

In reality, many NTBs apply to goods that are not homogeneous, but are instead differentiated products (e.g., apparel, shoes), which may be produced under monopolistic competition. In principle, the problem of product differentiation could be solved if we had retail prices of the exact same imported varieties across different locations (as in Goldberg and Verboven (2000) or Haskel and Wolf (2001) for example). However, such data are rare and limited in terms of country coverage.[16] The retail prices reported in the EIU CityData are average prices of a sample of varieties found in retail stores in each city.[17] The data do distinguish between "department store" price and "chain store" price (where the latter is likely to be relatively more homogenous), and an attempt is made to include in the samples only prices of goods of internationally comparable quality. However, at best, these data allow us to obtain an average NTB rent across the various varieties of a good sampled. Moreover, if the samples differ substantially across cities in quality, style or source, then (1) requires further adjustment. Otherwise, a price difference due to these factors may be

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[15] Transforming this NTB rent into an *ad valorem* equivalent tariff would require division of *q* by the c.i.f. price of *imported x* in country *i*.

[16] The OECD PPP price data, such as those used by Bradford, are an alternative source of retail price data. These data are similar to the EIU data in terms of level of aggregation, number of products, and care in matching product varieties. However, unlike the EIU data, the OECD data only cover OECD members, and are available only at the country level.

[17] Retail prices reported in the EIU CityData are simple averages, not consumer price indexes. This has the advantage that our price comparisons are not affected by cross-city differences in consumption shares, as they would be with CPIs. For more information on EIU CityData prices, see http://eiu.enumerate.com/asp/wcol_HelpPrices.asp

misattributed to the NTB. In many cases, the foreign trading partner has an NTB on the same product. Without controlling for this on the right side of equation (1), the price impact of the home country NTB would be mismeasured. There may also be multiple NTBs imposed by both trading partners, requiring further data to extract the impact of one type of barrier from another. Finally, there are also likely to be tax or other regulatory differences between countries. Their differential effects need to be stripped out of the retail prices in (1) in order to isolate the rent from the NTB.

To address these complexities, consider that the EIU CityData price of a good x in city i is the simple average of a sample of the varieties of good x found in retail stores in city i. Let the number of varieties sampled in city i and produced in city j be n_{ij}. Then the average price of the varieties from city j (sampled in city i) will be:

$$P_{ij} = \frac{1}{n_{ij}} \left[\sum_{k=1}^{n_{ij}} (P_{j(k)} + \mu_{ij(k)} + d_{ij} + t_{ij} + q_{ij}) \right], \tag{2}$$

where $P_{j(k)}$ denotes the "ex factory" price of k produced in city j, $\mu_{ij(k)}$ denotes the retail markup in city i on the variety k produced in city j, and are d_{ij}, t_{ij} and q_{ij}, are the transport cost, specific tariff and NTB rent, respectively, on imports from j. These latter are assumed to be the same across varieties from the same source city, hence no k subscript.

Let N_i be the total number of varieties sampled in city i, and let M be the total number of cities. Then the EIU price of good x in city i can be written as a weighted average of the average prices from each source city j:

$$P_i^R = \sum_{j=1}^{M} \theta_{ij} P_{ij}, \tag{3}$$

where the weights $\theta_{ij} = (n_{ij} / N_i)$ are the share of total varieties sampled in city i from each source j. Substituting equation (2) into equation (3) yields:

$$P_i^R = \frac{1}{N_i} \sum_{j=1}^{M} \sum_{k=1}^{n_{ij}} (P_{j(k)} + \mu_{ij(k)}) + \sum_{j=1}^{M} \theta_{ij} (d_{ij} + t_{ij} + q_{ij}). \tag{4}$$

If the sample of varieties is the same in all cities, then $n_{ij} = n_j$, $N_i = N$. Given this assumption, equation (4) can be written as:

$$P_i^R = \overline{P} + \overline{\mu}_i + \sum_{j=1}^{M} \theta_j (d_{ij} + t_{ij} + q_{ij}), \tag{5}$$

where $\overline{P} = \dfrac{1}{N_i} \sum_{j=1}^{M} \sum_{k=1}^{n_{ij}} P_{j(k)}$, $\overline{\mu}_i = \dfrac{1}{N_i} \sum_{j=1}^{M} \sum_{k=1}^{n_{ij}} \mu_{ij(k)}$, and $\theta_j = n_j / N$.

Equation (5) specifies a relationship between the retail price in city i and the NTB rent premium earned on trade between city i and every other city, under the assumption of common samples across cities. This provides the starting point for our econometric specification.

4. Econometric Specification

To arrive at our econometric specification, let us rewrite equation (5) using simpler notation as

$$P_i^R = \overline{P} + \mu_i + D_i + T_i + Q_i, \tag{6}$$

where D_i, T_i, and Q_i stand for the weighted averages of their lower-case counterparts. Following Deardorff and Stern, a price difference equation can be written from equation (6) to consider all possible pair-wise comparisons. Specifically, the "price gap" for any pair of cities (i, i*), can be expressed as

$$PG_{ii*} \equiv P_i^R - P_{i*}^R = \mu_i - \mu_{i*} + D_i - D_{i*} + T_i - T_{i*} + Q_i - Q_{i*}. \tag{7}$$

After allowing for slope coefficients, and a disturbance term, this leads to our basic estimating equation:

$$PG_{ii*} = \beta(\mu_i - \mu_{i*}) + \gamma(D_i - D_{i*}) + \delta(T_i - T_{i*}) + \sigma(Q_i - Q_{i*}) + \varepsilon_{ii*}, \tag{8}$$

where β, γ, δ and σ are parameters to be estimated. This specification attempts to explain the observed price gaps (or deviations from the law of one price) given observed differences in local markups, transport costs, and differences in tariff and non-tariff trade barriers; plus some random, unexplained factors subsumed in ε. Equation (8) delivers an estimate of the average price premium (σ) across all countries due to a more restrictive NTB.

In deriving (7) and (8), we were able to difference out $\overline{P}$, the average ex factory price, because of the assumption of common sampling. However, if the

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actual samples differ across cities, there could be differences in average ex factory prices that we may not wish to treat as part of the error term. For example, if each city sells varieties of goods that are produced domestically but not sold internationally (as in Melitz, 2003), and such goods are included in each city's sample, then average ex factory prices would most likely vary by country, and $\overline{P}$ would not difference out completely.[18] This possibility (among other factors discussed in the next section) motivates our inclusion of a constant term in (8) and (9), and the use country controls or country-pair effects in our specifications.

Equation (8) is extended to allow for a flexible response of prices to NTBs along two important dimensions: the potential interplay between tariff and non-tariff barriers, on the one hand, and the potential relationship between income level and effective market access, on the other hand. Theory suggests that the price effects of a tariff and an NTB on a product may differ from the effects of either barrier alone (Vousden, 1990). Take the case of an import quota. If a given quota is binding, it will increase the domestic price of a product. However, the magnitude of its effect will depend on the extent of pre-existing tariff protection on that product. If there is no tariff on the product, the entire price increase will be attributable to the import quota. As long as the quota is binding, the additional imposition of a tariff should not affect the price impact of the quota.[19] However, if a tariff exists prior to the imposition of the quota, only the price increase over the tariff-inclusive domestic price will be attributable to the quota. Thus, the joint impact of the quota and the tariff on domestic price would be less than the sum of the impact of each barrier alone. This suggests that our coefficient of interest in (8), σ, may not be constant, but may vary with tariffs. A simple way to allow for such a variable coefficient is to introduce an interaction term between the NTB and tariff variables.[20]

Empirical evidence of protection across countries suggests that high income countries' tariff barriers are generally lower than those of developing countries. The conclusion is then drawn that market access is relatively higher in

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[18] If we interpret θ_j as the share of all internationally-traded varieties exported by j, and let ω denote the non-traded share of all varieties found in the sample in each city, then $\theta_{ij} = (1 - \omega)\theta_j$ and (5) becomes: $P_i^R = \overline{P}^T + \omega(\overline{P}_i^N - \overline{P}^T) + \overline{\mu}_i + (1 - \omega)\sum_{j=1}^{M} \theta_j (d_{ij} + t_{ij} + q_{ij})$

where $\overline{P}^T$ is the average ex factory price of traded varieties and $\overline{P}_i^N$ is the average ex factory price of non-traded varieties in city i. The latter is likely to be function of country characteristics.

[19] If the tariff is sufficiently high to render the quota non-binding, then the tariff would cause the domestic price to increase further.

[20] Clearly the impact of the tariff also varies with the presence or absence of a binding NTB. Again, the joint impact of a tariff and an NTB on domestic price could be less than the sum of the impact of each barrier alone. The interaction term between the tariff and NTB variables in equation (9) would also account for this differential effect of tariff.

more developed countries. Yet the use of more restrictive NTBs by richer countries could negate this seemingly open market access. If the restrictiveness of NTBs varies with income levels, then again the coefficient σ would not be constant. KNO explore this relation between NTB restrictiveness and country income by plotting, post estimation, their estimated NTB margins against GDP per capita. Here we test this possibility directly by introducing a term interacting NTB and GDP per capita. This allows for a heterogeneous impact of NTBs on prices, depending on country income. An estimated positive coefficient, for instance, would then suggest that, all else equal, these core NTBs are more restrictive in richer countries.

Both of these modifications are introduced in the following equation:

$$PG_{ii*} = \beta(\mu_i - \mu_{i*}) + \gamma(D_i - D_{i*}) + \delta(T_i - T_{i*}) + \tag{9}$$
$$\sigma_0(Q_i - Q_{i*}) + \sigma_1(Q_i \tilde{Y}_i - Q_{i*} \tilde{Y}_{i*}) + \sigma_2(Q_i \tilde{T}_i - Q_{i*} \tilde{T}_{i*}) + \varepsilon_{ii*}$$

where $\tilde{Y}_i$ and $\tilde{T}_i$ are deviations from mean GDP per capita and mean tariffs. The coefficient σ_0 now indicates the average price premium due to NTBs, while σ_2 captures the degree to which the impact of the NTB varies with the tariff. Whether the restrictiveness of the NTBs (σ_0) rises or falls with the income level of the country will be shown by σ_1.[21] Using the predicted parameters for σ_0, σ_1, and σ_2 in equation (9), we can assess how the conditional average impact of NTBs on retail prices varies along different values of $\tilde{Y}_i$ and $\tilde{T}_i$. These parameters can then be used to construct country-specific estimates of the price premium due to a more restrictive NTB.

5. Data

Data from 115 cities are used to estimate equation (8) and (9).[22] Some countries have multiple city observations in the CityData, suggesting a panel estimation approach, by product, with country-pair fixed or random effects and corrections for clustering. However, for many developing countries in the sample, there is only one city observation for a given product. Thus, estimation at the individual product level with country-pair effects is not practical. One alternative would be to retain in our sample only countries with multiple city observations. But this

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[21] We have introduced these interaction terms consecutively as a robustness check. This alternate specification does not affect any of our main results.
[22] Some countries drop out due to missing wage or rent data: Bangladesh, Cameroon, Gabon, Pakistan, Panama, Senegal, and Vietnam. Occasionally price data are unavailable for specific city/product pairs.

would imply that most of the developing countries would drop out of the sample. To retain these developing countries, we chose to expand the observations for each country by estimating (8) and (9) on small groups of products. The 102 products were first grouped into "sectors," with each sector containing a small group of related products. By adding useful (within-group) variation along the product dimension, this treatment also improves identification of the price impact of core NTBs, while retaining corrections for country-pair heterogeneity.

Four of these sectors—fruits and vegetables, bovine meat, processed food, and apparel—were chosen for analysis.[23] These four sectors contain 47 products, and were chosen because one or both of the databases showed high frequencies of NTBs on these products. As shown in figure 1b, all of the products included in fruits and vegetables and in bovine meat show an NTB incidence that exceeds the mean in both databases, and 15 of these 20 products show a TRAINS incidence exceeding one standard deviation above the mean. All 12 apparel products show a USITC incidence exceeding one standard deviation above the mean.[24] Of the 15 processed food products, about half show TRAINS incidence at or above the mean.[25] Estimation is done separately for each sector.

The dependent variable is retail price in 2001, corresponding to the year of the ITC NTB database. Price data designated as "supermarket" or "chain store" are used rather than "mid-priced" or "branded store," to minimize the price differential due to brand name or quality differences. Data were converted to US dollars by EIU CityData using 2001 market exchange rates.

Since countries with higher per-capita income often have higher non-traded service costs in general—the so-called Balassa-Samuelson effect (Balassa, 1964; Samuelson, 1964)—we expect retail markups to be higher in richer countries. Unfortunately, no data are available on markups for local distribution costs at the city level. However the EIU CityData does contain very comprehensive city-level data on wages for one non-traded service—maid service. Thus, we include maid's hourly wages as a proxy for city-level non-traded service wages. Recognizing that these data are an imperfect proxy for retail distribution service costs, we also include city-level data on housing costs (a

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[23] All products are listed in Appendix 1. Products 1-10 make up Fruits and Vegetables, 11-20 are Bovine Meats, 34-48 are Processed Food, and 64-75 are Apparel.

[24] While TRAINs records a relatively low number of countries with NTBs on the apparel products, it is well known from the literature on the Multifiber Arrangement, that these few countries' NTBs were highly restrictive.

[25] The other sectors that also show similarly high NTB incidence include dairy and beverages/tobacco. We did not include dairy because we do not have data that can sufficiently control for the well-known complex domestic price support systems in the US and EU that impact the prices of these products. We did not include the beverage/tobacco sector due to the lack of data on domestic alcoholic beverage and tobacco taxes.

non-traded good) using the rental on a 1-bedroom furnished apartment,[26] and GDP per capita[27] as an additional control. Appendix II lists the countries included in the sample. For each country, the appendix shows the number of cities for which data are available and average values for the wage and rent variables in 2001. While there is a generally positive correlation between GDP per capita, wage and rent, the correlations are far from perfect. This suggests that each of these indicators will strengthen our ability to capture differences in local distribution costs across cities.[28]

Our specification calls for weighted average transport costs, weighted average tariffs, and weighted NTB rents for city i, where the weights represent the shares of varieties produced in each city j, θ_{ij}. We assume that a country which exports a relatively large share of the world's exports of a product is likely to produce a relatively large share of the world's varieties of this product. Thus, θ_{ij} is simply a country's share of global exports of each of the 47 products included in the sample.[29]

The ideal variable for estimating the impact of NTBs in equations (8) and (9) would be NTB rents by country by product. Since these data are not available, we take advantage of the two NTB incidence databases described in section 2. The TRAINS dummy variable takes a value of 1 if any of the NTBs designated "Quantity Control Measures" are present for a given product.[30] The ITC dummy variable takes a value of 1 if the ITC database records an import restriction,

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[26] Rental on commercial property is not widely available in developing countries, and not necessarily representative of the costs of doing business locally. In tests using alternate proxies (rental on 3-bedroom furnished apartments, and monthly wages for maid service), the results appear insensitive to the proxy for retail markup.

[27] Because city income per capita is not readily available, GDP per capita is calculated at the country level using data from the World Bank, World Development Indicators. These were calculated as the ratio of current GDP to population and are essentially on an exchange rate basis. An alternate possibility would be to use GDP per capita measured on a purchasing-power-parity basis. Denoting exchange-rate GDP as GDP_{xr}, purchasing-power parity GDP as GDP_{ppp} and the absolute price level as P_{ppp} we have $\ln GDP_{ppp} = \ln GDP_{xr} - \ln P_{ppp}$. Thus, in a log-log regression, using any two of the three variables captures the available information. The procedure used here replaces the aggregate absolute price level with two specific prices--for labor services and for building rental services--whereby we expect to capture the deviations from PPP that are most important for determining retail prices of traded goods.

[28] We thank an anonymous reviewer for highlighting the likely intra-city variation in markups across products. Unfortunately, while our markup data is city-specific, it is not product-specific. Thus, we cannot control for this type of variation in the markup.

[29] Export data are from the Comtrade database in WITS.

[30] These measures are in category 6000 and include: non-automatic licensing, prior authorizations, quotas, prohibitions, export restraint arrangements (e.g., VERs, OMAs, the Mulitfibre Arrangement), enterprise-specific restrictions (e.g., selective approval of importers; enterprise-specific quotas). The data are from WITS.

import quota, prohibition, or import license on that product. Since these two incidence measures potentially provide complementary information regarding the existence of NTBs, equations (8) and (9) are estimated using the union of the two. A single NTB dummy variable is constructed that takes a value of 1 if either TRAINS or the ITC database indicates the presence of an NTB. This composite NTB dummy is then weighted by θ_{ij}.

Following some of the gravity literature, we proxy transport costs with remoteness, where remoteness in our analysis is defined as the export-share-weighted sum of the great circle distance from each city to all other cities in our sample.[31] Tariffs are measured using the multilateral rates available in the MAcMAP database (Bouët et al., 2005). This source contains the most complete data currently available on preferential rates, and converts specific and compound tariffs to ad-valorem equivalents using the median unit value of exports in a reference group of countries chosen according to level of development and openness. This approach is a compromise between using bilateral unit values, which often result in extreme outliers, and global average unit values, which ignore quality differences. The tariff equivalents of TRQs are calculated in a manner that takes into account the fill status of quotas.[32] Appendix II shows average tariffs as well as import shares, by country and by product group.

6. Estimation and Results

Column (1) in Tables 1 through 4 shows the estimation of equation (8) by least squares for four of the product groups with high NTB coverage: fruits and vegetables, bovine meats, processed food, and apparel. All variables but NTB are measured in logs.[33] As column (1) in Table 1 indicates, many of the estimated coefficients show the expected sign. The wage and rent variables have positive and significant coefficients, as we would have expected from their roles as proxies for markups. The estimated coefficient for GDP per capita is also positive, supporting the stylized observation that consumer prices are higher in richer countries. Distance has a positive significant impact on retail price, as we would expect if it serves as a proxy for transport costs. Tariffs also have a

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[31] Export weights are constructed for each product group.

[32] In earlier versions of this paper, we relied on MFN tariffs and ad valorem equivalents (AVEs) calculated in WITS. The WITS data differ from MAcMaps in that they did not include preferential tariffs or incorporate TRQs. The WITs data also used different methodologies to calculate AVEs. http://wits.worldbank.org/witsweb/Doc/default.aspx

[33] We opted for a log-linear transformation based on early diagnostic plots and Box Cox analysis of equation (6) that suggested the use of log-transformed variables as an appropriate transformation to normality.

positive and significant impact on price, with an average impact below one as expected. While the positive relationship between the price gap and GDP per capita, distance and tariff does not hold in all sectors, the expected signs are seen in most cases.

The estimated coefficient for NTB, however, is notably against our expectations. As column (1) in Table 1 shows, for the fruits and vegetables sector, the average effect of NTB is unexpectedly estimated at -0.24. This parameter would suggest that a higher NTB, on average, *decreases* the price of fruits and vegetables by 24 percent. Negative parameters are also found for bovine meat and processed food. Only apparel shows a positive average increase in price of 12 percent due to NTBs.[34] Although it may be possible to conceive of large country cases where terms of trade effects may imply that prices fall as a result of protection, we believe these negative point estimates have more to do with some important empirical problems. Thus, several different estimation procedures are subsequently explored.

There are a number of possible confounding factors that would bias the results and preclude any causal inference on the impact of NTBs on prices. A first concern would be that some of the observed variation in the city price gap variable may be due to country-specific unobserved heterogeneity, such as trade infrastructure, taxes and other domestic regulations. To address this, column (2) in Tables 1-4 shows the estimated parameters after incorporating country-pair random effects into regression equation (8).[35] Introducing country pair effects into the regression framework seems to affect the point estimates for NTBs significantly in all but apparel. Indeed, the estimated coefficient for NTBs increases substantially, but remains negative for fruits and vegetables and for processed food. Clearly, though helpful in controlling for country-level unobservables, the incorporation of country-pair effects is not enough to overcome the identification issues that might be induced by other channels of endogeneity at the product level.

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[34] Note that all apparel results are presented excluding Egypt from the sample. While Egypt had no NTB on apparel, it did have a MAcMaps average tariff that was an extreme outlier. See the apparel tariff data in appendix II. Exclusion of Egypt did not affect the apparel results in table 4.
[35] Fixed effect estimation gives comparable results. Also, given the hierarchical structure of the data, we considered the estimation of nested country-pair and city-pair effects. This approach, however, was computationally demanding and did not provide significantly different results.

Table 1. Estimation Results for the Fruits and Vegetables Sector, 2001.

	Fruits and Vegetables				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP-PC	0.118**	0.092**	-0.003	0.066**	0.017
	(0.010)	(0.009)	(0.012)	(0.009)	(0.016)
Wage	0.167**	0.167**	0.181**	0.142**	0.170**
	(0.013)	(0.012)	(0.012)	(0.012)	(0.012)
Rent	0.187**	0.111**	0.204**	0.107**	0.196**
	(0.011)	(0.007)	(0.011)	(0.007)	(0.010)
Dist	0.153**	0.103**	-0.047**	0.090**	-0.052**
	(0.010)	(0.009)	(0.013)	(0.009)	(0.014)
Tariff	0.454**	0.498**	0.376**	0.583**	1.117**
	(0.034)	(0.032)	(0.036)	(0.049)	(0.087)
NTB	-0.235**	-0.164**	0.465**	-0.124**	0.445**
	(0.014)	(0.015)	(0.043)	(0.015)	(0.043)
NTB*Tariff				-0.250**	-1.210**
				(0.065)	(0.119)
NTB*GDP-PC				0.095**	0.017
				(0.011)	(0.019)
Constant	-0.042**	-0.069**	-0.070**	-0.070**	-0.053**
	(0.010)	(0.008)	(0.009)	(0.008)	(0.009)
Country Effects	No	Yes	Yes	Yes	Yes
IV	No	No	Yes	No	Yes
N	52439	52439	52439	52439	52439
R-sq	0.376	0.369	0.342	0.384	0.337

Notes: All variables but NTB are measured in logs. All terms refer to pairwise differences. Country effects refer to country-pair effects, modeled as random effects. Estimated standard errors corrected for unknown heteroskedasticity and clustering in parenthesis. The symbols **, * and † indicate significance at the 1%, 5% and 10% levels, respectively. R-sq for columns (2) to (5) are pseudo R-squares.

Table 2. Estimation Results for the Bovine Meat Sector, 2001.

	Bovine Meat				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP-PC	0.166**	0.212**	0.197**	0.224**	0.082**
	(0.013)	(0.011)	(0.012)	(0.017)	(0.017)
Wage	0.030†	0.059**	0.046**	0.060**	0.039*
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Rent	0.318**	0.125**	0.177**	0.125**	0.177**
	(0.015)	(0.008)	(0.007)	(0.008)	(0.007)
Dist	-0.163**	-0.156**	-0.181**	-0.162**	-0.178**
	(0.030)	(0.021)	(0.020)	(0.020)	(0.021)
Tariff	0.536**	0.112**	0.067*	0.337**	-0.001
	(0.029)	(0.027)	(0.026)	(0.082)	(0.101)
NTB	-0.132**	-0.002	0.504**	-0.019	0.601**
	(0.025)	(0.024)	(0.046)	(0.029)	(0.048)
NTB*Tariff				-0.270**	0.097
				(0.084)	(0.109)
NTB*GDP-PC				-0.021	0.170**
				(0.019)	(0.020)
Constant	-0.066**	-0.094**	-0.090**	-0.091**	-0.100**
	(0.012)	(0.010)	(0.010)	(0.010)	(0.010)
Country Effects	No	Yes	Yes	Yes	Yes
IV	No	No	Yes	No	Yes
N	37506	37506	37506	37506	37506
R-sq	0.512	0.426	0.427	0.427	0.428

Notes: All variables but NTB are measured in logs. All terms refer to pairwise differences. Country effects refer to country-pair effects, modeled as random effects. Estimated standard errors corrected for unknown heteroskedasticity and clustering in parenthesis. The symbols **, * and † indicate significance at the 1%, 5% and 10% levels, respectively. R-sq for columns (2) to (5) are pseudo R-squares.

Table 3. Estimation Results for the Processed Food Sector, 2001.

	Processed Food				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP-PC	-0.079**	-0.053**	-0.108**	-0.057**	-0.107**
	(0.008)	(0.005)	(0.007)	(0.006)	(0.007)
Wage	0.142**	0.105**	0.103**	0.093**	0.107**
	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)
Rent	0.189**	0.113**	0.168**	0.111**	0.174**
	(0.007)	(0.005)	(0.008)	(0.005)	(0.009)
Dist	0.088**	0.103**	0.003	0.098**	0.000
	(0.020)	(0.012)	(0.015)	(0.013)	(0.015)
Tariff	0.336**	0.099**	-0.136**	0.156**	-0.198**
	(0.035)	(0.030)	(0.036)	(0.029)	(0.050)
NTB	-0.133**	-0.053**	0.370**	-0.065**	0.394**
	(0.011)	(0.011)	(0.028)	(0.010)	(0.031)
NTB*Tariff				-0.130*	0.094
				(0.056)	(0.101)
NTB*GDP-PC				0.048**	-0.029*
				(0.008)	(0.014)
Constant	-0.028**	-0.022**	-0.018**	-0.025**	-0.017**
	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)
Country Effects	No	Yes	Yes	Yes	Yes
IV	No	No	Yes	No	Yes
N	76564	76564	76564	76564	76564
R-sq	0.157	0.147	0.132	0.145	0.133

Notes: All variables but NTB are measured in logs. All terms refer to pairwise differences. Country effects refer to country-pair effects, modeled as random effects. Estimated standard errors corrected for unknown heteroskedasticity and clustering in parenthesis. The symbols **, * and † indicate significance at the 1%, 5% and 10% levels, respectively. R-sq for columns (2) to (5) are pseudo R-squares.

Table 4. Estimation Results for the Apparel Sector, 2001.

	Apparel				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
GDP-PC	-0.072**	-0.004	-0.020	-0.048**	0.067**
	(0.011)	(0.013)	(0.013)	(0.013)	(0.014)
Wage	0.161**	0.166**	0.108**	0.163**	0.119**
	(0.015)	(0.019)	(0.023)	(0.018)	(0.022)
Rent	0.224**	0.095**	0.136**	0.087**	0.138**
	(0.012)	(0.010)	(0.012)	(0.010)	(0.012)
Dist	-0.016	0.015†	0.074**	0.035**	0.067**
	(0.012)	(0.008)	(0.014)	(0.009)	(0.014)
Tariff	-0.653**	-0.063	-0.277**	0.147	1.030**
	(0.087)	(0.073)	(0.082)	(0.100)	(0.197)
NTB	0.118**	0.136**	0.495**	0.229**	0.454**
	(0.017)	(0.016)	(0.083)	(0.019)	(0.077)
NTB*Tariff				-0.435	-2.625**
				(0.143)	(0.370)
NTB*GDP-PC				0.117**	-0.207**
				(0.014)	(0.027)
Constant	-0.002	-0.003	0.002	-0.005	-0.003
	(0.011)	(0.009)	(0.009)	(0.009)	(0.009)
Country Effects	No	Yes	Yes	Yes	Yes
IV	No	No	Yes	No	Yes
N	59143	59143	59143	59143	59143
R-sq	0.259	0.214	0.209	0.208	0.230

Notes: All variables but NTB are measured in logs. All terms refer to pairwise differences. Country effects refer to country-pair effects, modeled as random effects. Estimated standard errors corrected for unknown heteroskedasticity and clustering in parenthesis. The symbols **, * and † indicate significance at the 1%, 5% and 10% levels, respectively. R-sq for columns (2) to (5) are pseudo R-squares.

We attempt to handle these potential identification issues by implementing an instrumental variables approach that would allow us to separate the effects of NTBs *per se* from the confounding effects of reverse causality, selection and measurement error. We expect that an NTB on a product raises that product's price (a positive relationship). At the same time, relatively low prices may be a signal of heavy import competition. Under such price competition from imports, industries may be more likely to win a bid for protection via an NTB (a negative relationship).[36] This two-way causality would likely bias the price impact of NTBs downwards. Since we only observe the effects of NTBs for those countries that implement them, there may also be uncontrolled characteristics correlated with the incidence of NTBs and with higher prices, which would lead to selection bias. Finally, given the particular difficulty of measuring NTBs, our estimates may reflect attenuation bias due to a poorly measured NTB variable. In our instrumental variables estimation, we therefore assume that NTBs are endogenous.

In a 1993 study, Trefler formulated a two-equation structural model of the determinants of NTBs and imports across U.S. industries. Lee and Swagel (1997) (LS) formulated a similar model, but estimated this model using both industrial and developing country data. Trefler and LS both argue that NTBs are less likely to be imposed on export-oriented industries, at least in part because of fear of foreign retaliation. Each study finds a strong negative relation between an industry's ratio of exports to total output (or consumption), and the likelihood of an NTB. I.e., a country is less likely to impose an NTB on a product, the more that product is exported rather than consumed at home. Both Trefler and LS also argue that import penetration (or its growth) is likely to be positively-related to the willingness of legislators to impose NTBs, but that import penetration is clearly affected by comparative advantage (both studies) and by distance (LS). Results in LS show a strong negative impact of distance on import penetration, and thereby indirectly on the likelihood of an NTB.

Finally, LS argue that an NTB may be a complement to, or substitute for a tariff.[37] Hence, the tariff itself is an important determinant of the likelihood of an NTB. Their evidence strongly supports the idea that tariffs and NTB are complements, used together to increase the protection granted to an import-competing sector. Earlier empirical evidence suggests that NTBs have been used as: (1) substitutes for tariffs, to replace tariff protection negotiated away in GATT rounds; (2) complements to tariffs, to increase protection on consumer goods, textiles and apparel, and agriculture (Ray and Marvel, 1984, p.451). The

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[36] Trefler (1993) makes a similar argument with regard to NTBs and import volumes. While an NTB depresses the volume of imports (a negative relationship), a large volume of imports could be the reason behind the implementation of the existence of the NTB (a positive relationship). Trefler's simultaneous equations model shows strong support for this hypothesis.

[37] Both Trefler and Lee and Swagel take the tariff variable as being predetermined, with their existence and levels restricted by WTO commitments.

Multifiber Agreement is a well known example of using NTBs and tariffs as complements. The US negotiated VERs on textiles and clothing with many countries, covering many products, even though these products faced high tariffs (USITC, 2002).[38] Similar policies were implemented by the EU and Canada.[39]

While we cannot construct the full set of determinants which would emerge from reduced forms of either of these models, we can nonetheless include three of these variables in our analysis: tariffs, distance, and the importance of exports in an industry. Lacking complete industrial output data for all countries and products in our sample, we cannot measure the ratio of exports to output or domestic consumption. But we can measure the extent to which this product is an important export for a country, using the ratio of that industry's exports to the country's total exports. This ratio (w) varies by both country and industry. If this ratio is high, we assume that this is a relatively important export for the country, and hence less likely to be restricted by an NTB. This assumption seems reasonable, since countries do not generally impose NTBs on industries that are significant exporters (Trefler and LS). Further, in the absence of trade frictions, these export shares should not affect city retail prices directly. Unlike tariffs and distance, these export shares affect the price of the tradable only indirectly through their effect on the existence of an NTB. Under these assumptions, w_i is a valid instrument, and the estimation of our model can be conducted following the endogenous treatment effect literature (Angrist and Imbens, 1995; Angrist and Krueger, 2001). Equation (8) is, therefore, estimated in a two-stage procedure, where the first stage entails the estimation of the incidence of an NTB using tariffs, distance, the other exogenous variables, and the instrument w_i.

Column (3) in Tables 1-4 shows the estimated parameters for a regression with country-pair effects where the NTB variable is treated as endogenous and estimated using the instrumental variable approach just described.[40] As these results show, this estimation approach has a large impact on the parameter for NTBs, which is now positive and significant in the three sectors which previously had negative coefficients, and significantly larger in apparel. Based on these new

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[38] In the case of textiles and apparel, a second motive for the use of NTBs and tariffs might be to impose discriminatory protection. A similar motive might lie behind the US imposition of a worldwide quota on US wheat gluten imports in the late 1990s--in addition to existing tariffs--in response to the ITC finding that the US industry had been injured. Although the quota was worldwide, part of it was allocated to a few large sellers, and these quotas were binding, while those on the smaller sellers were not (USITC, 2002). A third motive might be because tariff binding commitments left no overhang, and thus no room to increase protection via tariffs

[39] Note that the implementation of NAFTA in 1994 and Everything But Arms in 2001 means that US, EU and Canadian 2001 average applied apparel tariffs would be much lower than the corresponding MFN rates.

[40] First-stage regression results are included as Appendix 3.

estimates, NTBs, on average, raise the prices of fruits and vegetables, bovine meats, processed food and apparel by 47 percent, 50 percent, 37 percent and 50 percent, respectively.

The remaining columns in Tables 1-4 show the results after incorporating the interaction effects between NTBs and tariffs, and between NTBs and country income in equation (9). Column (4) estimates the model allowing for country-pair effects, while column (5) additionally considers treatment for endogeneity through instrumental variables. As in Heckman and Vytlacil (1998), the instrumental variables estimation of column (5) proceeds by predicting NTBs based on the exogenous variables and the instrument, and using these predicted values in place of the NTB dummy and its interactions in equation (9).[41] Once again, accounting for endogeneity makes a large difference in the estimated direct effect of the NTB on price. The three sectors with negative values for the NTB in equation (9) (column (4)), now show positive significant values in column (5). In apparel, the positive value for the NTB variable again increases in size. Columns (3) and (5) suggest that accounting for endogeneity is important in assessing the impact of NTBs on price.

For a country with average income and an average tariff, the estimated effects of the NTB from equation (9) are very similar to those from equation (8). The interaction terms in column (5) show how the NTB price premia vary for countries with tariffs and incomes that deviate from the average. First stage results show a positive significant correlation between the tariff rate and the probability of an NTB, supporting the idea that tariffs and NTBs are complements in these four sectors (appendix III). However, theory suggests that the interaction of tariffs and NTBs could have a negative impact on the NTB price premium, since the price impact of the two barriers together is less than the sum of their individual effects alone. A negative significant interaction is found in fruits and vegetables and in apparel, but no statistically significant interaction in the other two sectors. The hypothesis that the restrictiveness of NTBs varies with country income is supported by the results in bovine meat, processed food and apparel, but not in fruits and vegetables. Richer countries appear to have more restrictive NTBs on bovine meat than poorer countries. However, the opposite is true for processed food and apparel.

Of the regression models considered, the ones that provide us with an expected positive sign for the average effect of NTBs are those where an instrumental variables approach is conducted. The other specifications suggest a considerable downward bias in the NTB coefficient estimate, if NTBs are wrongly taken as exogenous. Column (5) is, thus, our preferred econometric model for all sectors. The endogeneity of apparel NTBs is puzzling, and merits

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[41] See Wooldridge (2003) for a proposed variation.

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further discussion. By 2001, countries were in the second stage of the Agreement on Textiles and Clothing (ATC), and were removing existing NTBs acccording to the ATC timetable. They were also restrained from adding any new core NTBs, and from tightening the existing ones (See USITC, 2002). This suggests that the apparel NTBs were exogenous in 2001. However, some countries did impose safeguards during this time, in response to the removal of specific NTBs under the ATC.[42] The countries initiating the successful actions were the US, Argentina, Brazil, Ecuador, and Columbia.[43] Because safeguards replaced a few existing NTBs, but are not included in our NTB incidence measure, they could introduce some measurement error due to misclassification.

Drawing on the estimated parameters of specification (9), we can derive country-specific estimates of the average effect of NTBs on prices by sector, under the restriction that countries with similar tariff barriers and standards of living exhibit, on average, similar NTBs premia. These estimates are presented in Table 5 and Figure 2.[44] Of the 65 countries in the sample, 46 have NTBs on fruits and vegetables, with NTB premia ranging from 2-61 percent, and averaging 44 percent. Most of the countries in the sample (55 out of 65) have NTBs on bovine meat. These NTBs are more restrictive on average (54 percent), and span a wider range (2-90 percent) than fruits and vegetables. Forty-six countries have processed food NTBs, but these premia are lower on average (41 percent), and fall in a narrower range (34-53 percent). In contrast, only 37 out of 65 countries have significant apparel NTB premia. With the exception of India and Zimbabwe, the low income developing countries do not have apparel NTBs. For these two countries, and the remaining middle and high income economies, apparel NTB premia range from 8-97 percent, with an average of 50 percent. The estimates for the US, EU and Canada fall reasonably within the range found in the large literature on the export tax equivalent of apparel NTBs (e.g., Khaturia and Bhardwaj, 2001).

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[42] We thank an anonymous reviewer for pointing this out.

[43] These five countries and Poland initiated a total of 52 safeguard actions between 1995 and 2001. However, only 16 cases were sustained. Of the other cases, a few ended in bilateral settlements (Reinert, 2000; Kim and Reinert, 2007).

[44] Table 5 shows NTB premia estimates for a sector if a country has an NTB on at least one product in that sector. Blanks indicate no NTB in that sector, conditional on the availability of product price data. There are a few cases (7% of the sample) where product price data are unavailable. To the extent that some of those products face NTBs, we are unable to estimate their impact.

Figure 2. **Price Effects of NTBs by Sector and Income.**

Fruits and Vegetables

GDP per capita

NTB Estimate   TRAINS only NTB Estimate

Bovine Meat

GDP per capita

NTB Estimate   TRAINS only NTB Estimate
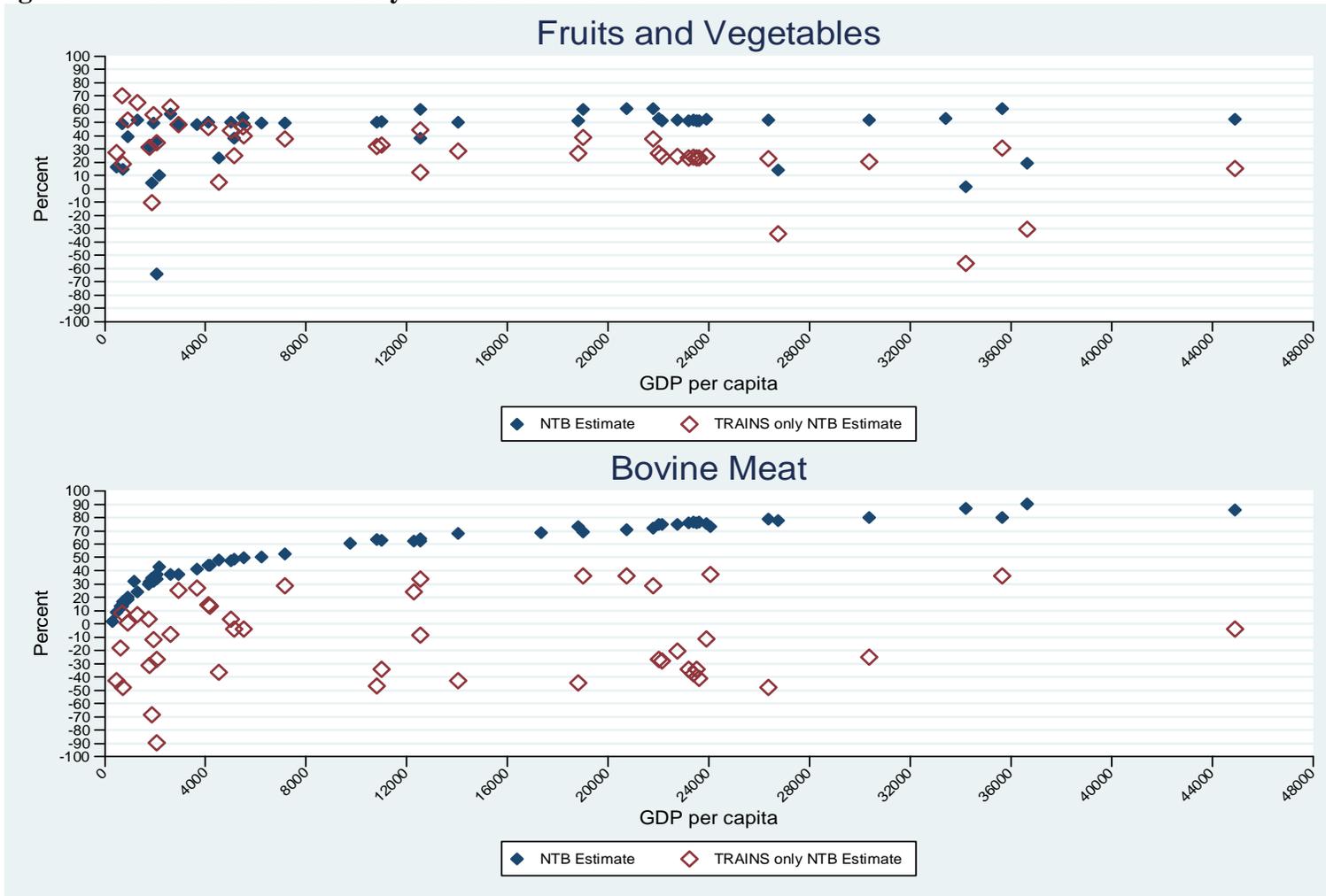
Figure 2. Price Effects of NTBs by Sector and Income (continued)
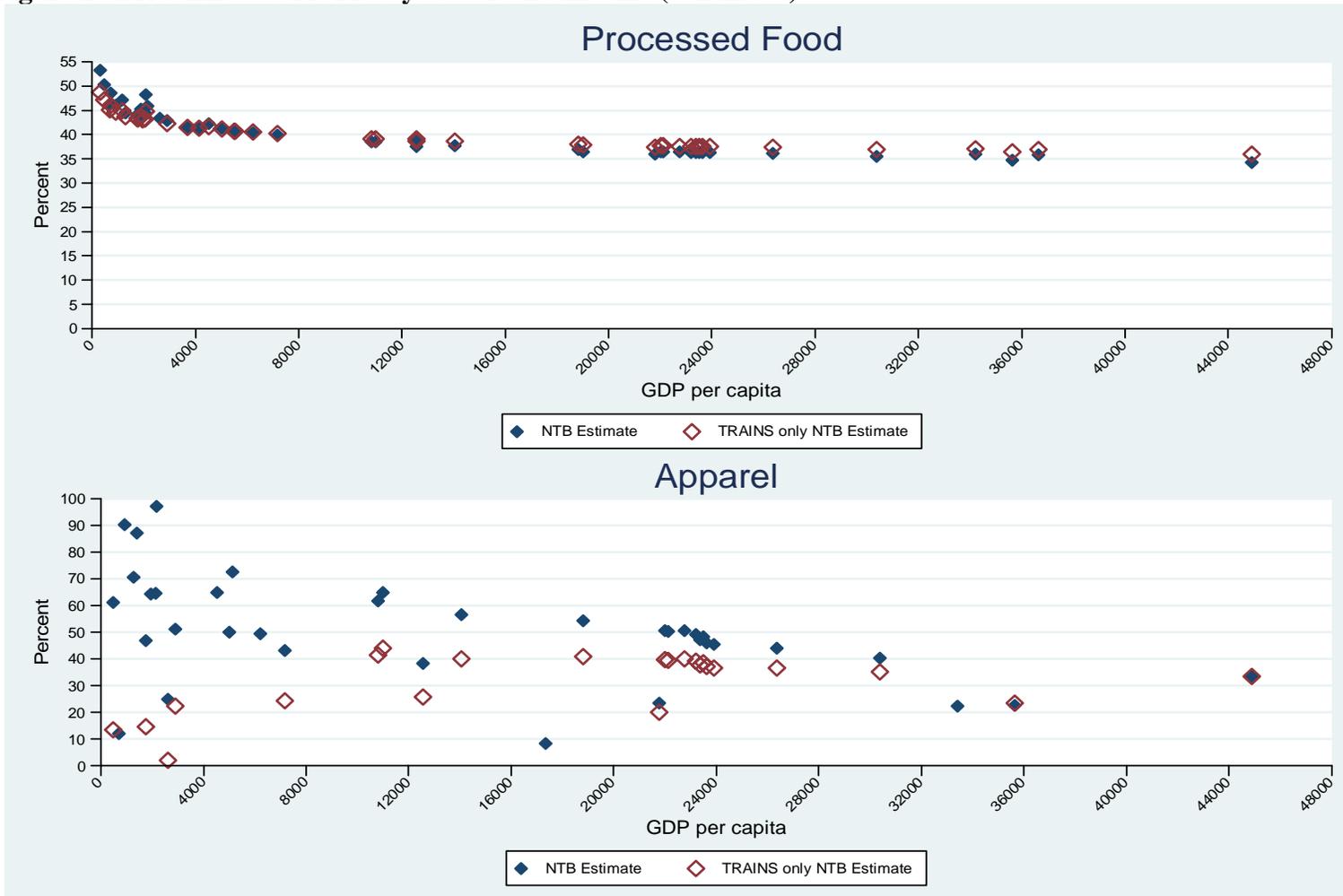
Table 5. Country Estimates by Sector, 2001.

	Fruits/Veg.	Bovine Meat	Proc. Food	Apparel
Argentina	0.496	0.526	0.399	0.430
Australia	0.600	0.691	0.365	
Austria	0.514	0.760	0.363	0.492
Azerbaijan				
Bahrain		0.622		
Belgium	0.516	0.749	0.364	0.502
Brazil	0.485	0.372	0.428	0.512
Canada	0.605	0.718	0.360	0.236
Chile	0.500	0.438	0.413	
China		0.202		
Colombia	0.494	0.320	0.439	0.644
Costa Rica		0.440		
Cote d'Ivoire		0.130		
Czech Republic	0.488	0.497	0.405	
Denmark	0.521	0.803	0.356	0.404
Ecuador				0.871
Egypt				
Finland	0.514	0.763	0.364	0.482
France	0.531	0.747	0.365	0.506
Germany	0.518	0.750	0.364	0.506
Greece	0.506	0.631	0.385	0.649
Guatemala			0.441	
Hong Kong		0.731		
Hungary	0.380	0.485		0.726
Iceland	0.143	0.775		
India	0.163	0.088	0.502	0.612
Indonesia	0.493	0.133	0.463	
Ireland	0.521	0.789	0.361	0.440
Israel		0.688		0.083
Italy	0.516	0.729	0.369	0.543
Japan	0.530			0.224
Jordan		0.295		0.469
Kenya				
Korea, Republic of		0.605		
Luxembourg	0.524	0.860	0.343	0.335
Malaysia	0.483	0.412	0.415	
Mexico	0.497	0.504	0.403	0.494
Morocco		0.321	0.472	
Netherlands	0.519	0.763	0.363	0.473
New Zealand	0.599	0.620	0.376	
Nigeria		0.017	0.532	
Norway	0.196	0.903	0.359	
Paraguay	0.518	0.240	0.445	0.705
Peru	0.359	0.337	0.444	
Philippines	0.395	0.184	0.460	0.902
Poland	0.234	0.479	0.423	0.648
Portugal	0.500	0.635	0.385	0.617
Romania	0.322	0.314	0.442	
Russian Federation				0.646
Saudi Arabia				
Singapore	0.607	0.706		
South Africa	0.564	0.370	0.433	0.249
Spain	0.500	0.678	0.377	0.565
Sri Lanka				
Sweden	0.516	0.767	0.363	0.462
Switzerland	0.015	0.872	0.360	
Taiwan	0.383	0.641	0.387	0.382
Thailand	0.045	0.343	0.453	

Table 5. Country Estimates by Sector, 2001 (continued).

	Fruits/Veg.	Bovine Meat	Proc. Food	Apparel
Tunisia	-0.639	0.370	0.482	
Turkey	0.102	0.427	0.458	0.970
United Kingdom	0.525	0.754	0.363	0.454
United States	0.606	0.800	0.346	0.226
Uruguay	0.535		0.405	
Venezuela	0.504	0.477	0.413	0.499
Zimbabwe	0.148	0.164	0.485	0.121

Note: Country-specific effects from estimated equation (9) shown for a county with an NTB on at least one of the products in a given sector. NTBs are treated as endogenous. Blanks indicate no NTBs in that sector.

Figure 2 shows no discernible relationship between NTB premia for fruits and vegetables, but a much clearer relationships between income and premia in bovine meat, processed food and apparel. Bovine meat premia grow rapidly as incomes rise from poorest to middle income countries, then rise more slowly as income grows further. In this sector there seems to be a somewhat quadratic relationship between the NTB premia and income, supporting the idea that richer countries have more restrictive NTBs than poorer ones. In processed food, higher income countries clearly have less restrictive NTBs than developing countries, though the difference in absolute terms is not large. The apparel results are noteworthy. While figure 2 suggests a positive relationship between income and apparel NTB premia, this relationship appears driven by unusually high estimates for a few middle income countries. As mentioned above, the only low income countries in the figure are India and Zimbabwe. Interestingly, some of the middle income countries with the highest NTB premia are Argentina, Brazil, Columbia and Ecuador--the countries which attempted to impose safeguards on some apparel exporters and products.

To gain a better understanding of the importance of the two NTB databases in the analysis, we re-estimated the country-specific NTB premia in each sector, using only the TRAINS database to capture NTB incidence. These NTB premia are also shown in Figure 2. In processed food, where the NTB premia fell within a narrow range, the TRAINS-only NTB premia show a flatter relationship with income--lower estimates for lower middle income countries, and higher estimates for upper middle and high income countries. However, the differences are small. In both bovine meat and fruits and vegetables, where NTB premia display a wider range of values, the TRAINS-only NTB premia tend to be significantly lower than the estimates using both databases, and show little relationship to income levels. In apparel, the TRAINS-only premia suggest that NTB premia and income are positively related, and in particular show much lower premia for lower middle income countries, Zimbabwe and India. These differences suggest that at least in some sectors, the addition of complaint data may bring independent information on the significance of NTBs, which TRAINs does not include.

7. Conclusions

This paper improves our ability to quantify the price effects of NTBs for many countries and many products. Recent studies have derived *ad valorem* equivalents for NTBs for a large number of countries and/or products, but this has required *indirect* estimation due to either lack of price data or NTB incidence measures. In this analysis we use city level retail price data to *directly* estimate the impact of core NTBs on prices, and assess their significance, for four sectors, comprised of 47 consumer products, for more than 60 countries in 2001. Three key features of the analysis include: the use of self-reported government data (TRAINS) and private sector complaint data (ITC database) to assess NTB incidence; the use of an explicit differentiated products model to capture imperfect substitutability between products; the use of city level price data-- including both inter- and intra-country price differences--to more precisely distinguish the impact of NTBs from local distribution costs in raising price. The model is estimated using an instrumental variables approach to incorporate the endogeneity of NTBs. Interactions are included to capture the potential for the restrictiveness of NTBs to vary with tariffs and with income levels.

Overall our results suggest that NTBs represent an important source of trade frictions for many countries and many traded goods. Country-specific NTB price premia estimates for fruits and vegetables and for bovine meat are high, averaging about 44 and 54 percent, respectively, but variation across countries is wide. NTB premia for processed foods are lower on average (41 percent) with relatively narrow variance. Apparel NTB premia show both a high average (50 percent) and a very wide range. Results strongly suggest that NTBs are endogenous. In particular, NTBs are more likely to be imposed the higher the tariff on a product. However controlling for the interaction of barriers has important implications for the estimates. In fruits and vegetables and in apparel, the joint use of tariffs and NTBs significantly reduces the impact of the NTB on price. Allowing NTB restrictiveness to vary with income also proves important. While there is very little discernible relationship between the two in fruits and vegetables, there is strong evidence that higher income countries had more restrictive NTBs on bovine meat, but less restrictive NTBs on processed food and apparel in 2001. The apparel results are somewhat surprising, given that many low income countries are apparel exporters and do not have core NTBs on the product. A closer look reveals that these results are driven largely by unusually restrictive NTBs in a few middle income countries (particularly in Latin America).

While the importance of using both government self-reported NTB data and private sector complaint data is difficult to discern, some evidence does emerge. For processed food products where there is a narrow range of NTB

premia across countries, there is little difference between premia estimates using only TRAINS data and those using both databases. However, in the other sectors where NTB premia display a wider range of values across countries, using TRAINS-only incidence data appears to understate the restrictiveness of NTBs. In apparel, the use of TRAINS-only incidence data tends to reverse the relationship between the estimates and income, apparently understating the restrictiveness of lower middle income countries by more than upper middle income countries. This does suggest that at least in some sectors, the use of complaint data to augment government self-reported data may supply independent information which significantly raises the estimated restrictiveness of core NTBs.

APPENDIX I. EIU CityData Products and HS Classification

Product Name	No.	HS Codes		Product Name	No.	HS Codes			Product Name	No.	HS Codes	
Apples	1	080810		Drinking chocola	36	180610			Mens raincoat	71	620112	620113
Bananas	2	080300		Frozen fish fing	37	160420			Women's raincoat	72	620212	620213
Carrots	3	070610		Flour, white	38	110100			Socks, wool mixt	73	6115	
Lemons	4	080530		Ground coffee	39	0901			Tights	74	6115	
Lettuce	5	070511		Instant coffee	40	0901			Women's cardigan	75	6110	
Mushrooms	6	070951		Orange juice	41	2009			Child's shoes, dress	76	640420	
Onions	7	070310		Peaches, canned	42	200870			Men's shoes, business	77	640420	
Oranges	8	080510		Peas, canned	43	200540			Child's shoes	78	640411	
Potatoes	9	070190		Sliced pineapple	44	200820			Women's shoes, town	79	640420	
Tomatoes	10	070200		Spaghetti	45	190219			Toilet tissue	80	481810	
Beef: ground or	11	0201	0202	Tea bags	46	090230			Facial tissues	81	481820	
Beef: roast	12	0201	0201	Tomatoes, canned	47	200210			Daily local news	82	490210	
Beef: stewing	13	0201	0202	White bread	48	190590			International foreign daily newspaper	83	490210	
Beef: filet mignon	14	0201	0202	Beer, local brand	49	220300			Paperback novel	84	4901	
Lamb: chops	15	0204		Beer, top quality	50	220300			International weekly newspaper	85	490290	
Lamb: leg	16	0204		Cognac, French V	51	220820			Dishwashing liquid	86	340220	
Lamb: Stewing	17	0204		Gin, Gilbey's	52	220850			Insect-killer spray	87	380810	
Beef: steak	18	0201	0202	Liqueur, Cointre	53	220870			Laundry detergen	88	340220	
Veal: chops	19	0201	0202	Scotch whisky	54	220830			Soap	89	340111	
Veal: roast	20	0201	0202	Vermouth, Martin	55	220510			Aspirins	90	291822	
Bacon	21	021012		Wine, table	56	220421			Hand lotion	91	330430	
Chicken: fresh	22	0207		Wine, fine	57	220421			Lipstick (deluxe	92	330410	
Chicken: frozen	23	0207		Wine, superior	58	220421			Shampoo & condit	93	330510	
Ham: whole	24	021011		Coca-Cola	59	220210			Toothpaste with	94	330610	
Pork: loin	25	0203		Mineral water	60	220110			Kodak colour film	95	370231	
Pork: chops	26	0203		Tonic water	61	220210			Frying pan	96	732393	
Margarine	27	151710		Cigarettes, Marlboro	62	240220			Razor blades	97	821220	
Olive oil	28	1509		Pipe tobacco	63	240310			Personal compute	98	847141	
Peanut or corn oil	29	150890	151529	Boy's jacket	64	620331	620333	620332	Batteries	99	8506	
Butter	30	040510		Business suit, men's	65	620311			Electric toaster	100	851672	
Cheese, imported	31	0406		Boy's dress trousers	66	620341	620343		Light bulbs	101	853922	
Milk, pasteurise	32	040120		Child's jeans	67	620342			Compact disc	102	852432	
Yoghurt, natural	33	040310		Dress	68	6204						
Cocoa	34	180500		Girl's dress	69	6204						
Cornflakes	35	190410		Business shirt	70	620520	620530					

Appendix II. Descriptive Statistics, 2001

	Cities[1] (#)	GDP PC[2] (USD)	Wage[1] (USD)	Rent[1] (USD)	Fruits/Veg.		Bovine Meat		Processed Food		Apparel	
					Tariff[4] (%)	Import Share[3] (%)	Tariff[4] (%)	Import Share[3] (%)	Tariff[4] (%)	Import Share[3] (%)	Tariff[4] (%)	Import Share[3] (%)
Argentina	1	7170	5.5	450	8.4	0.52	0.8	0.09	10.0	0.5	15.3	0.69
Australia	5	19011	9.38	465	0.5	0.03	0.0	0	3.0	0.48	23.1	1.2
Austria	1	23210	6.54	549	15.6	0.41	67.9	0.17	16.4	0.58	3.8	2.45
Azerbaijan	1	701	1.72	450	15.9	0.51	10.7	0.07	15.2	0.57	14.8	0.11
Bahrain	1	12289	5.26	684	3.5	1.14	4.9	0.29	3.9	1.09	9.9	0.42
Belgium	1	22129	6.69	647	15.5	0.41	60.5	0.17	15.7	0.58	3.7	2.45
Brazil	2	2915	2.46	455	7.9	0.09	0.5	0.11	13.6	0.15	19.4	0.14
Canada	4	21787	12.57	705	0.3	0.36	4.7	0.25	1.3	0.62	14.0	0.74
Chile	1	4126	3	360	7.0	0.22	7.0	1.03	6.8	0.35	6.6	1.33
China	5	911	3	1550	20.5	0.06	34.2	0.01	23.6	0.03	21.8	0.25
Colombia	1	1939	2.15	237	6.5	0.32	19.9	0.02	11.5	0.45	17.9	0.24
Costa Rica	1	4171	1.66	400	12.0	0.11	7.8	0.07	9.7	0.55	13.6	2.23
Cote d'Ivoire	1	634	0.73	482	19.0	0.37	19.9	0.05	19.0	0.26	20.0	0.36
Czech Republic	1	5519	9.25	925	9.1	0.33	18.5	0.01	7.8	0.35	9.2	0.51
Denmark	1	30382	12.14	910	15.1	0.41	59.3	0.17	16.8	0.58	5.6	2.45
Ecuador	1	1396	5.66	250	8.9	0.33	20.0	0.01	14.1	0.28	10.9	0.35
Egypt	1	1525	3.05	411	25.0	0.08	5.0	0.92	30.7	0.17	731.8	0.37
Finland	1	23513	22.7	530	15.9	0.41	72.9	0.17	17.7	0.58	4.1	2.45
France	2	22010	9.78	614	13.0	0.41	58.6	0.17	15.9	0.58	3.6	2.45
Germany	5	22759	10.41	773	14.7	0.41	48.2	0.17	16.3	0.58	3.2	2.45
Greece	1	10986	5.28	713	14.6	0.41	98.1	0.17	16.9	0.58	3.6	2.45
Guatemala	1	1766	2.54	1930	12.1	0.21	8.3	0.28	10.5	1	21.4	0.39
Hong Kong	1	24074	8.33	2564	0.0	0.21	0.0	0.07	0.0	0.16	0.0	3.43
Hungary	1	5140	1.96	285	19.2	0.15	18.2	0.02	29.1	0.28	5.8	0.76
Iceland	1	26744	10.07	504	63.9	0.36	30.3	0	1.6	1.21	3.3	1.85
India	2	463	0.53	381	37.5	0.02	35.0	0	42.0	0.06	34.4	0.03
Indonesia	1	695	0.36	929	4.9	0.23	5.0	0.08	4.7	0.25	13.5	0.01
Ireland	1	26357	7.44	858	14.9	0.41	86.8	0.17	20.5	0.58	5.2	2.45
Israel	1	17350	8.74	699	73.5	na	15.9	na	13.5	na	23.2	na
Italy	2	18826	8.13	534	14.6	0.41	79.4	0.17	16.8	0.58	3.4	2.45
Japan	2	33418	16.22	2911	7.5	0.29	35.0	0.69	27.8	0.5	10.5	2.75
Jordan	1	1755	5.63	309	23.2	0.64	10.3	0.94	20.8	0.73	27.5	0.2
Kenya	1	339	0.67	506	27.9	0.04	27.8	0.01	26.0	0.39	34.3	0.08
Korea, Republic of	1	9748	5.43	1550	53.8	0.12	35.8	0.56	19.2	0.2	12.4	0.89
Luxembourg	1	44903	7.8	780	16.1	0.41	34.1	0.17	13.9	0.58	5.1	2.45
Malaysia	1	3678	3.95	237	11.0	0.2	0.0	0.2	5.2	0.08	14.3	0.04
Mexico	1	6214	4.29	1269	8.9	0.15	3.4	0.57	9.9	0.12	14.6	0.84
Morocco	1	1156	0.66	527	50.6	0.03	213.1	0.01	37.9	0.32	49.0	0.37
Netherlands	1	23379	8.16	816	14.8	0.41	72.3	0.17	16.8	0.58	4.7	2.45
New Zealand	2	12543	7.43	491	0.0	0.33	0.0	0.18	1.3	0.75	8.8	0.9
Nigeria	1	318	4.44	1500	100.0	0	25.0	0	76.0	0.19	55.0	0.01
Norway	1	36662	11.3	847	47.9	0.45	180.0	0.06	22.7	0.66	2.4	1.91
Paraguay	1	1285	5.74	391	3.8	0.25	7.7	0.01	5.4	0.47	18.9	0.55
Peru	1	2051	1.48	862	19.2	0	29.6	0	20.2	0	19.2	0

Appendix II. Descriptive Statistics, 2001

	Cities[1] (#)	GDP PC[2] (USD)	Wage[1] (USD)	Rent[1] (USD)	Fruits/Veg. Tariff[4] (%)	Fruits/Veg. Import Share[3] (%)	Bovine Meat Tariff[4] (%)	Bovine Meat Import Share[3] (%)	Processed Food Tariff[4] (%)	Processed Food Import Share[3] (%)	Apparel Tariff[4] (%)	Apparel Import Share[3] (%)
Philippines	1	912	0.97	311	15.3	0.06	8.5	0.29	11.0	0.17	13.7	0.02
Poland	1	4518	1.9	600	35.9	0.58	40.2	0	23.2	0.48	10.2	0.45
Portugal	1	10822	3.68	606	16.1	0.41	78.5	0.17	16.1	0.58	5.9	2.45
Romania	1	1772	1.16	205	22.7	0.34	27.7	0.1	12.4	0.63	13.2	0.52
Russian Federation	2	2141	3.61	700	10.4	1.34	10.2	1.39	11.5	0.9	16.9	0.43
Saudi Arabia	3	8711	6.67	1037	9.5	0.76	0.0	0.58	9.7	0.86	11.7	0.87
Singapore	1	20733	7.14	1200	0.0	0.11	0.0	0.05	0.0	0.17	0.0	0.47
South Africa	1	2620	1.77	648	0.8	0	15.7	0.08	16.2	0.15	34.7	0.32
Spain	2	14046	7.24	632	16.3	0.41	75.2	0.17	15.5	0.58	5.6	2.45
Sri Lanka	1	873	1.11	222	26.5	0.72	25.0	0.02	23.7	0.08	9.7	0.32
Sweden	1	23624	28.44	664	15.5	0.41	75.2	0.17	17.2	0.58	5.3	2.45
Switzerland	2	34209	19.35	881	80.4	0.25	140.9	0.11	19.0	0.42	1.2	2.16
Taiwan	1	12549	11.54	813	19.7	0.09	26.2	0.2	15.3	0.09	12.5	0.39
Thailand	1	1876	1.04	404	55.0	0.08	60.0	0	29.3	0.07	47.5	0.08
Tunisia	1	2071	1.39	194	154.0	0.12	83.2	0	82.4	0.19	30.0	0.58
Turkey	1	2154	2.31	512	50.5	0.15	200.0	0	48.3	0.08	3.3	0.17
United Kingdom	2	23917	11.4	990	14.3	0.41	54.6	0.17	17.5	0.58	5.6	2.45
United States	16	35649	23.58	1171	0.9	0.25	2.2	0.26	2.8	0.36	10.1	2.99
Uruguay	1	5483	3.73	477	4.4	0.5	8.3	0	7.9	0.93	17.0	0.82
Venezuela	1	5012	3.69	900	7.0	0.18	14.5	0.07	13.7	0.3	15.7	0.6
Zimbabwe	1	706	0.45	90	39.7	0.08	40.0	0	33.3	0.09	56.4	0.05

[1] Data are from EIU CityData, for the year 2001. [2] Data are from World Bank, World Development Indicators 2006. [3] Data are from TRAINS using WITS. Share of total imports in 2001 or nearest available year. EU import shares are shown for the fifteen EU member countries. [4] Data are from MAcMap for the year 2001.

Appendix 3: First-Stage Estimation Results by Sector

	Fruits/Veg.	Bovine Meat	Proc Food	Apparel
GDP-PC	0.741**	0.094	0.673**	0.142*
	(0.083)	(0.091)	(0.070)	(0.065)
Wage	-0.187†	0.370**	-0.086	0.389**
	(0.105)	(0.136)	(0.092)	(0.086)
Rent	-0.834**	-0.799**	-0.643**	-0.341**
	(0.090)	(0.124)	(0.077)	(0.069)
Dist	0.785**	0.456	0.581**	-0.523**
	(0.106)	(0.283)	(0.130)	(0.092)
Tariff	0.016	1.980**	2.013**	1.741**
	(0.316)	(0.401)	(0.415)	(0.628)
Exp Share (w)	-26.408**	-16.922**	12.367*	-22.751**
	(7.905)	(4.375)	(5.093)	(5.682)
Constant	-7.459**	36.768**	-8.670**	9.882**
	(1.272)	(10.832)	(1.503)	(1.074)
N	1029	864	1522	1191
R-sq	0.301	0.370	0.237	0.246
F-Stat for Instrument	11.16	14.98	5.91	16.03

Notes: Dependent variable is NTB dummy. Robust standard errors shown in parenthesis. The symbols **, * and † indicate significance at the 1%, 5% and 10% levels, respectively.

References

Anderson, J. and P. Neary (1992). "Trade Reforms with Quotas, Partial Rent Retention and Tariff," *Econometrica*, 90 (1), 57-76.

Andriamananjara, S., J. M. Dean, R. Feinberg, M. Ferrantino, R. Ludema, M. Tsigas (2004). "The Effects of Non-Tariff Measures on Prices, Trade, and Welfare: CGE Implementation of Policy-Based Price Comparisons," USITC Economics Working Paper No. 2004-04-A.

Angrist, J. and G. Imbens (1995). "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity," *Journal of the American Statistical Association*, 90 (430), 431-442.

Angrist J. and A. Krueger (2001). "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments," *Journal of Economic Perspective*, 15 (4), 69-85.

Balassa, B. (1964). "The Purchasing Power Parity Doctrine: A Reappraisal," *Journal of Political Economy*, 72 (4), 584-596.

Baldwin, R. (1975). *Foreign Trade Regimes and Economic Development: The Philippines.* National Bureau of Economic Research, New York: Columbia University Press.

Bhagwati, J. and T. N. Srinivasan (1975). *Foreign Trade Regimes and Economic Development: India.* National Bureau of Economic Research, New York: Columbia University Press.

Bouët, A., Y. Decreux, L. Fontagné, S. Jean, and D. Laborde (2005). "A Consistent Picture of Applied Protection Across the World," TRADEAG Working Paper 05-05, downloaded from http://ageconsearch.umn.edu/bitstream/18859/1/wp050005.pdf on July 29, 2008.

Bradford, S. (2005). "The Extent and Impact of Final Goods Non-Tariff Barriers in Rich Countries," in P. Dee and M. Ferrantino, eds., *Quantitative Methods for Assessing the Effects of Non-Tariff Measures and Trade Facilitation,* Singapore: World Scientific Publishing.

Bradford, S. (2003). "Paying the price: final goods protection in OECD countries", *Review of Economic and Statistics* 85 (1), 24-37.

Dean, J. M., R. Feinberg, J. Signoret, and M. Ferrantino and R. Ludema (2006). "Estimating the Price Effects of Non-Tariff Measures," USITC Working Paper No. 2006-06-A.

Dean, J. M., R. Feinberg, M. Ferrantino and R. Ludema (2005). "Estimating the Tariff Equivalent of NTMs," in P. Dee and M. Ferrantino, eds., *Quantitative Methods for Assessing the Effects of Non-Tariff Measures and Trade Facilitation,* Singapore: World Scientific Publishing.

Deardorff, A. and R. Stern (1998). *Measurement of Non-Tariff Barriers,* University of Michigan Press.

Donnelly, W. and D. Manifold (2005). "A Compilation of Reported Non-Tariff Measures: Description of the Information," USITC Working Paper EC2005-05-A.

Economics Intelligence Unit (2002). EIU CityData., available at http://www.eiu.com.

Francois, J. and D. Spinanger (2000). "The Cost of EU Trade Protection in Textiles and Clothing," manuscript.

Ferrantino, M. (2006). "Quantifying the Trade and Economic Effects of Non-Tariff Measures," OECD Trade Policy Working Paper No. 28.

Goldberg, P. and F. Verboven (2000). "The Evolution of Price Dispersion in the European Car Market," *Review of Economic Studies*, 68 (4), 811-46.

Haskel, J. and H. Wolf (2001). "The Law of One Price – A Case Study," *Scandinavian Journal of Economics,* 103 (4), 545-558.

Heckman J. and E. Vytlacil (1998). "Instrumental Variables Methods for the Correlated Random Coefficient Model," *Journal of Human Resources*, 33 (4), 974-987.

Hufbauer, G., T. Warren and E. Wada (2002). *The Benefits of Price Convergence: Speculative Calculations.* Washington, DC: Institute for International Economics.

Hummels, D. and V. Lugovskyy (2006). "Are Matched Partner Trade Statistics Usable Measures of Transportation Costs?", *Review of International Economics*, 14 (1), 69-86.

Kee, H., A. Nicita, and M. Olarreaga (2006). "Estimating Trade Restrictiveness," World Bank Policy Research Working Paper No. 3840.

_____ (forthcoming). "Import Demand Elasticities and Trade Distortions," *Review of Economics and Statistics*.

Kathuria, S., and A. Bhardwaj (2001). "The Export Tax Equivalents of Quota Restrictions in the Indian Textile and Garment Industries," World Bank Working Paper.

Kim, S. and K. Reinert (2007). "Textile and Clothing Safeguards: from the ATC to the Future," *International Law and Trade Policy,* 8 (2), 155-174.

Leamer, E. (1988). "Measures of Openness," in R. E. Baldwin, ed., *Trade Policy and Empirical Analysis*, Chicago: University of Chicago Press and NBER.

Lee, J.W. and P. Swagel (1997). "Trade Barriers and Trade Flows across Countries and Industries," *Review of Economics and Statistics*, 79 (3), 372-382.

McCallum, J. (1995). "National Borders Matter: Canada-U.S. Regional Trade Patterns," American Economic Review, 85 (3), 615-623.

Melitz, M. J. (2003) "The Impact Of Trade On Intra-Industry Reallocations And Aggregate Industry Productivity," Econometrica, 71 (6), 1695-1725.

Ray, E. J. and R. Marvel (1984). "The Pattern of Protection in the Industrialized World," *Review of Economics and Statistics*, 66 (3), 452-58.

Reinert, K. (2000). "Give Us Virtue But Not Yet: Safeguard Actions Under the Agreement on Textiles and Clothing," *World Economy*, 23 (1), 25-55.

Samuelson, P. (1964). "Theoretical Notes on Trade Problems," *Review of Economics and Statistics*, 46 (2), 145-154.

Sanyal, K. and R. W. Jones (1982). "The Theory of Trade in Middle Products," *American Economic Review*, 72 (1), 16-31.

Saxonhouse, G. and R. Stern (1989). "An Analytical Survey of Formal and Informal Barriers to Trade and Investment in the United States, Canada, and Japan," in R. Stern, ed., *Trade and Investment Relations Among the United States, Canada, and Japan*, University of Chicago Press.

Trefler, D. (1993). "Trade Liberalization and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy," *Journal of Political Economy*, 101 (1), 138-160.

UNCTAD (2005). "Report on the Experts Meeting on Methodologies, Classification, Quantification, and Development Impacts of Non-Tariff Barriers," UNCTAD Document TD/B/COM.1/EM.27/3.

USITC (2002). *The Economic Effects of Significant Import Restraint, Third Update, 2002,* US International Trade Commission Publication No. 3519.

Vousden, N. (1990). *The Economics of Trade Protection*, Cambridge: Cambridge University Press.

Wooldridge, J. (2003). "Further Results on Instrumental Variables Estimation of Average Treatment Effects in the Correlated Random Coefficient Model," *Economic Letters*, 79 (2), 185-191.

WTO (2001). *Market Access Unfinished Business: Post-Uruguay Round Inventory and Issues.* WTO Special Studies No. 6.

WTO (2008). "Draft Modalities for Non-Agricultural Market Access," Geneva: WTO Document   TN/MA/W/103/Rev.3