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Quality-Adjusted Estimates of NTM Price Gaps

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ABSTRACT: The NTM analysis in this paper estimates supplier-specific price gaps for a number of countries in a way that allows for quality differences in exported products and the possibility that NTMs may have a greater or lesser impact on prices for imports from different sources. The estimation procedure uses bilateral trade statistics and compares the destination market's import prices (c.i.f. unit values) by supplier with the various suppliers' export prices (f.o.b. unit values) to the world. These supplier-specific price gaps can then be aggregated into price gaps for each product, by using quantities imported by supplier as weights. Results reveal new information about the variation in restrictiveness of NTMs across countries, products, and policies.

This paper represents solely the views of the authors and does not represent the views of the U.S. International Trade Commission or any of its Commissioners nor the views of The World Bank Group, its member countries, or its Executive Directors. The assistance of Julien Gourdon with data is gratefully acknowledged. Contact author: Michael J. Ferrantino

1. Introduction

Quantifying the restrictiveness of non-tariff measures remains a main challenge in trade policy analysis. Econometric analysis linking price dispersion with observed Non-Tariff Measures (NTMs) can provide estimates of average effects while controlling for confounding effects. However, this type of analysis can yield unreliable estimates at the disaggregated levels often needed for policy modeling—e.g., ad valorem equivalents (AVEs) that vary by destination, product, and supplier.

The NTMs' analysis in this paper estimates supplier-specific price gaps in a way that allows for both quality differences in exported products and the possibility that NTMs may have a greater or lesser impact on prices for imports from different sources. The estimation procedure uses bilateral trade statistics and compares the destination market's import prices (c.i.f. unit values) by supplier to the various suppliers' export prices (f.o.b. unit values) to the world. These supplier-specific gaps can then be aggregated into price gaps for each good, by using quantities imported by supplier as weights. Provided there is some trade among countries, this estimation can be carried out for every product.

2. Method

The issue of controlling for quality differences is endemic to attempts to estimate price gaps for NTMs. Standard methods, as described in Deardorff and Stern (1998) and Ferrantino (2006), begin by assuming that the domestic and international prices to be compared are for a homogeneous good demanded in all potential markets. However, this is unlikely to be the case. The quality of different goods varies in all potential markets. It is now well established that unit values contain both a quality effect (richer countries export products with higher unit values) and a pricing-to-market effect (richer countries import products with higher unit values) with the former effect believed to be predominant (Ferrantino, Feinberg, and Deason 2012) in most products. The formula used in this analysis attempts to capture the mentioned effects by accessing the price gap differences as we see them:

$$TE = \left(\frac{\sum \theta_{C,i} UV_{C,i}}{\sum \theta_{C,i} UV_{World,i}} \right) - 1 - \sum_i \theta_i \left(\frac{CIF}{FOB} - 1 \right)_{C,i}$$

This formula was first developed for USITC's single-importer studies of agricultural NTMs (USITC India: November 2009 and USITC China: November 2010). Specific parameters are as follows: Market Shares (θ_i) for aggregated exporters in Country (C), are calculated using available unit values for each country ($UV_{C,\,i}$) and total trade values from aggregated country specific exports as reported by WITS. UV_{World} is an estimated world unit value that averages export's ($UV_{C,\,i}$) for all countries in the world recognized by WITS. This formula allows for a component for transportation costs, in which market shares of imports (θ_i) are multiplied with the ratio of cost insurance and freight (CIF) to the products that are Free on Board (FOB).

For this analysis, the formula is modified by calculating a unit value world average estimate

($UV_{World,\,i}$) which when added to the original formula estimates a Price Gap or Tariff Equivalent (*TE*) that in ideal circumstances adjusts for product quality differences by the source of exports. The current analysis also omits transportation costs; and the formula used focuses on the following parameters:

$$TE = \left(\frac{\sum \theta_{C,i} UV_{C,i}}{\sum \theta_{C,i} UV_{World,i}} \right)$$

This formula yields estimated TEs which are then merged to the United Nations Conference on Trade and Development (UNTACD)'s Trade Analysis and Information System (TRAINS) NTMs database for the Transparency in Trade (TNT) initiative to produce an extensive list that allows for price gaps comparison.

At the time of analysis, UNTACD's TRAINS NTMs database had a limited number of countries with available information on specific NTM policy data, hence limiting the number of importer countries that could be analyzed. The importer countries analyzed in this paper are: Madagascar, Uganda, Tanzania, Nepal, Kenya, Senegal, Pakistan, India, Sri Lanka, Syria, Morocco, Tunisia, China, South Africa, Mauritius, Costa Rica, Lebanon, Kazakhstan, and Japan. For country specific (supplier) data the team collected available exports data for all countries on WITS for all categorized harmonized tariff schedule (HS) products at the sixth level (HS-6) under the 2002 nomenclature for three years (2008, 2009, 2010). Moreover, for countries in which WITS data are not available for all of the selected years, median value of the two years was used to generate TEs or as commonly referred throughout the paper: price gaps (for example Kazakhstan is 2008-2009, Nepal is 2009-2010). To calculate a $UV_{World,\,i}$ from all WITS recognized countries in the world and averaged the $UV_{C,\,i}$ values for each product using all trade values for the mentioned three years.

Data Specification:

It is imperative to ensure that data are accurate and that unit values used are in an unvarying measure across all products. In this analysis, CEPII's Trade Unit Value (TUV) database which provides standardized unit values in kilograms for products at the for selected countries (162 reporters, 254 partners, 5000 HS-6 codes per year) divided by with WITS' quantity trade value data for all the CEPII selected countries at the HS-6 product level) yields a Unit Value ($UV_{C,\,i}$) concordant to available products and bilateral country partners. This procedure automatically dropped data which did not have a direct CEPII to WITS product (at HS-6 level) and/or country concordance and provided non varying measures Unit Values ($UV_{C,\,i}$) to be used in the formula.

These $UV_{C,\,I}$ values were then averaged to create world unit value ($UV_{C,\,world}$) that makes up part of the denominator of this formula while $UV_{C,\,i}$ are used individually for each of the selected countries in the numerator.

Since this method averages the world unit values, $UV_{C,\,I}$, across different countries, it assumes that each product is a homogenous good and does not show specific quality adjustments for each country that is exporting. In that way, it does not deal with quality differences. However, this effect is offset by the individual countries import unit values that show product selection in the selected countries.

After using the formula to estimate a price gap for each year, the team calculated the median for each TE. This analysis does not focus in just one year, but in a series of three years to ensure that results are reflective of the circumstances in this specific country in a time period. The results of this merge were then used to combine results to UNTACD's (TRAINS) NTMS database. This produces a list of countries that shows NTMs by type and the median price gap or tariff equivalent. This extensive list shows which products have reported NTMs and how it compared to the price gaps. Hypothesis testing is as follows.

3. Data and Results:

As previously stated data must be accurate; and this analysis shows that NTM analysis is still a work in progress. Information on existing NTMs was obtained from the Transparency in Trade (TNT) initiative. The policies in the TNT data follow the UNCTAD classification described in Basu et al (2011) and at http://ntb.unctad.org/about.aspx . At the time of analysis, these data were limited to sixteen specific countries, and while available, these data face challenges when it comes to its accuracy and overall quality. Data concerns range from complete lack of data, lack of data from one year to another in some countries, to the data collection process not being uniform across countries. To add to these complexities, there are multiple policies on one product-all these anomalies that drive concerns to the use of the data. Also, since these data were collected in different countries by different consultants, there could be significant differences on what each consultant thought was relevant in collecting data which can alter the analysis process and consequently the results.

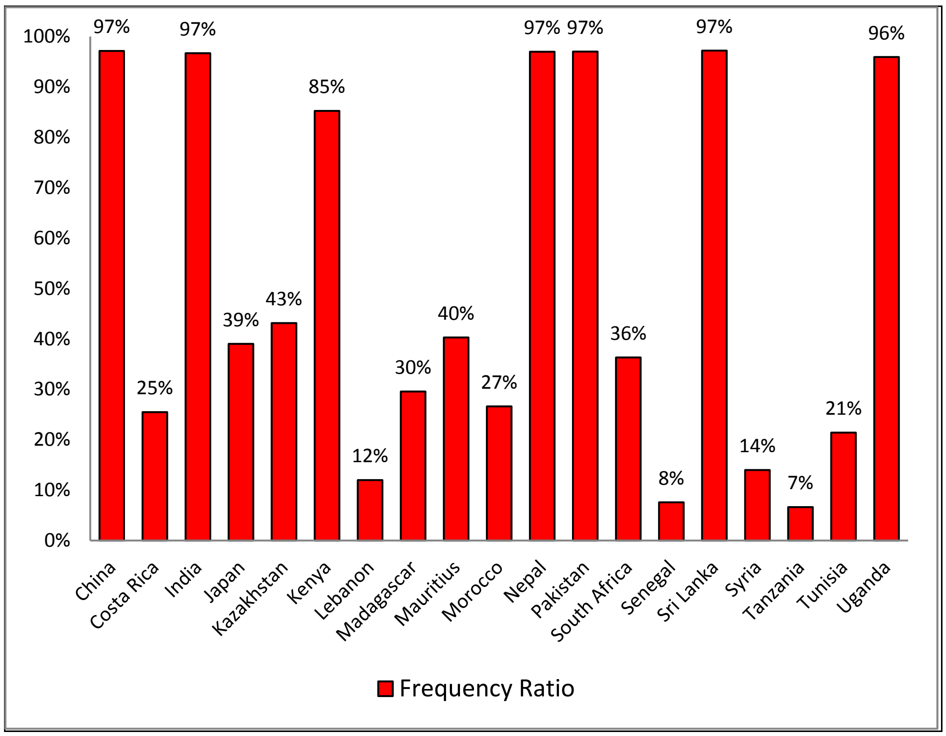
Other uses of the TNT data include Cadot and Gourdon (2011), which uses an econometric approach to estimate price effects for a group of African countries; Nicita and Gourdon (2013), calculate coverage ratios for NTMs by country, broad sector, and type of policy, and Cadot, Gourdon and Malouche (2013) use an econometric approach to estimate price gaps. Since our estimates are formula-based ("mass handicraft") and Cadot et al.'s estimates are econometric, they deal with non-NTM influences on unit values in different ways. The formula-based method used in this paper might be expected to correct for exporter effects more precisely than an econometric approach, but for importer effects not at all. There can be significant differences in the way we show these prices. As discussed, data obtained for this analysis has a number of issues that causes changes in results. Unit values were obtained from CEPII's TUV estimates database while traded quantities were obtained from bilateral trade data from WITS. By using the mentioned estimates and direct data, we created country unit values. While estimates were carefully calculated, not all products in all countries have a concordant CEPII Unit Value and that alters potential results.

Figure 1 shows the range of data availability for the selected countries. All countries have a different number of Total HS-6 Subheading per Country to identify potential price gaps. All selected countries were within the 1733-4677 of subheadings observations, the average at 3831, and the median at 4010; China could have as many as 4654, Japan 4677, but other such as Nepal has 1733 observations, showing that more transparent data is needed in all countries.

Figure 1: Total Subheadings

Country	Total HS-6 Subheadings
China	4654
Costa Rica	3565
India	4283
Japan	4677
Kazakhstan	4172
Kenya	4062
Lebanon	4252
Madagascar	3158
Mauritius	3881
Morocco	4122
Nepal	1733
Pakistan	3585
South Africa	4537
Senegal	3173
Sri Lanka	4010
Syria	3724
Tanzania	3310
Tunisia	4377
Uganda	3522

Figure 2: Frequency Ratio by Countries



Given the disparity in the types of products traded and the process in which data was processed, results yield different NTM frequency ratios as well. NTM frequency ratios were extremely different from one country to another. Figure 2 shows NTM frequency ratios for the analyzed countries, these ratios range from seven percent to 97 percent. Large countries developing countries such as China and India showed 97 percent; NTM frequency ratios, which were shared with smaller neighboring countries such as Nepal, Pakistan, and Sri Lanka. While African countries such as Senegal (8 percent) and Tanzania (7 percent) showed the lowest levels of NTM frequency, indicating that country size or amount of data available was not an issue that affects NTMs. Additionally, given that one product in one country can have more than one NTM it is impossible to distinguish which NTM is causing a price gap or to calculate the exact percentages into which these data and NTMs frequency ratios correspond.

That said, NTM policy data shows a variety of information which is summarized in Figure 3 arranged by countries. Results show that SPS, TBT, para-tariff measures, and other technical measures (e.g. pre-shipment inspection) are most common among NTMs the selected countries, while Finance, Anti-Competitive, Export Related and TRIMs are the least significant. Both SPS and TBT NTMs are high (greater than 80 percent) in China and Sri Lanka, while TBTs are greater than 80 percent in China, Kenya, Nepal, Sri Lanka. These results show that NTMs are high in China; but it is not clear what that ratio entails. Other Technical NTMs are high in Sri Lanka, and lower less than two percent in 13 out of the 19 selected countries. Price Control, Para-Tariff and export related is only significant in India. Also, only Nepal shows NTMs in the Finance sector.

Figure 3: Anomalies in the Policy Data, by Countries

Country	NTM	SPS	TBT	Other Technical	Price Control	Quant Control	Para-Tariff	Finance	Anti-Competitive	Export Related	TRIMs
China	97.2%	97.2%	97.2%	0.5%	1.1%	18.2%	0.0%	0.0%	5.3%	0.0%	0.0%
Costa Rica	25.5%	18.6%	14.6%	0.1%	0.0%	0.5%	3.6%	0.0%	0.5%	0.0%	0.0%
India	96.7%	0.0%	0.0%	1.7%	96.7%	5.7%	96.7%	0.0%	1.5%	96.7%	0.0%
Japan	39.0%	19.0%	24.4%	0.0%	0.7%	2.3%	5.9%	0.0%	0.0%	0.0%	0.0%
Kazakhstan	43.2%	24.4%	25.8%	14.2%	1.7%	9.6%	0.0%	0.0%	0.0%	0.0%	0.0%
Kenya	85.3%	22.7%	82.7%	46.7%	2.8%	26.1%	38.5%	0.0%	0.5%	0.0%	0.5%
Lebanon	12.0%	1.4%	10.6%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
Madagascar	29.6%	11.8%	10.0%	0.1%	1.9%	8.1%	6.1%	0.0%	0.1%	0.0%	0.0%
Mauritius	40.3%	25.8%	13.2%	0.4%	0.0%	14.3%	0.0%	0.0%	0.0%	0.0%	0.0%
Morocco	26.6%	10.0%	15.6%	9.2%	0.6%	4.4%	7.1%	0.0%	0.0%	0.0%	0.3%
Nepal	97.0%	10.5%	97.0%	0.0%	0.0%	4.2%	97.0%	97.0%	0.5%	0.0%	0.0%

Country	NTM	SPS	TBT	Other Technical	Price Control	Quant Control	Para-Tariff	Finance	Anti-Competitive	Export Related	TRIMs
Pakistan	97.0%	10.0%	18.7%	3.2%	0.3%	97.0%	97.0%	0.1%	0.0%	0.0%	0.0%
S_Africa	36.3%	21.7%	13.7%	0.3%	0.6%	0.1%	1.1%	0.0%	0.0%	0.0%	0.0%
Senegal	7.6%	2.5%	3.4%	0.9%	1.5%	2.4%	3.0%	0.0%	0.0%	0.4%	0.0%
Sri Lanka	97.2%	97.2%	97.2%	97.2%	0.0%	0.7%	97.2%	0.0%	0.0%	0.0%	0.0%
Syria	14.0%	0.9%	4.8%	0.0%	0.0%	2.1%	6.7%	2.1%	2.4%	0.0%	0.0%
Tanzania	6.6%	2.7%	5.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tunisia	21.4%	10.7%	9.8%	19.8%	0.8%	0.1%	19.6%	0.0%	1.9%	0.0%	0.0%
Uganda	95.9%	8.2%	31.7%	0.0%	0.0%	1.1%	54.9%	0.0%	0.0%	0.0%	0.0%

Grouping all NTMs by HTS sectors covered shows lower frequency ratios across HTS sectors; however, results continue to show a high level of disparity. Figure 4 shows the disparity across sectors:

Figure 4: Anomalies in the Policy Data, by HTS sectors

SECTION	NTM	SPS	TBT	Other Technical	Price Control	Quant Control	Para-Tariff	Finance	Anti-Competitive	Export Related	TRIMs
Animals and animal products	77.8%	66.8%	27.9%	19.8%	6.2%	13.4%	29.8%	3.5%	0.2%	4.2%	0.0%
vegetable products	73.3%	59.7%	26.0%	21.4%	8.5%	8.8%	33.5%	5.1%	0.8%	5.3%	0.0%
fats and oils	74.2%	61.1%	29.4%	22.3%	6.4%	10.5%	32.5%	4.9%	2.9%	5.1%	0.0%
prepared foods, beverages	79.0%	64.0%	30.3%	22.2%	7.0%	8.5%	30.2%	4.7%	1.6%	5.2%	0.4%
mineral products	55.2%	26.3%	32.3%	6.2%	7.3%	12.8%	27.1%	1.2%	1.7%	7.3%	0.0%
chemicals and products	61.5%	27.0%	38.8%	10.0%	6.8%	12.2%	26.8%	2.2%	0.8%	6.1%	0.2%
Rubber and plastics	45.1%	13.2%	26.3%	7.2%	5.8%	7.9%	24.2%	3.1%	0.5%	5.6%	0.0%
hides, leather, and skins	57.6%	32.9%	29.2%	9.7%	7.5%	6.8%	24.3%	1.3%	0.0%	8.1%	0.0%
wood, cork, and straw	47.6%	25.7%	18.3%	9.1%	3.8%	4.8%	21.9%	2.2%	0.3%	4.2%	0.0%
paper, pulp, and printing	40.2%	12.4%	26.2%	6.7%	6.2%	5.3%	25.2%	3.1%	0.2%	5.8%	0.0%
textiles and apparel	38.2%	13.1%	28.1%	6.6%	4.7%	3.6%	20.3%	3.3%	0.3%	4.6%	0.0%
footwear, headgear, etc	46.5%	13.0%	32.6%	7.3%	3.7%	4.0%	22.1%	2.1%	0.0%	3.7%	0.0%
stone, ceramics, and glass	33.3%	9.9%	24.2%	7.2%	4.8%	5.2%	19.0%	2.3%	0.1%	4.6%	0.0%
gems and jewelry	39.6%	16.5%	20.6%	7.5%	8.8%	10.6%	24.0%	0.7%	0.2%	9.0%	0.0%
metals and metal products	39.7%	12.4%	23.0%	10.2%	6.7%	11.8%	27.5%	2.3%	2.1%	6.0%	0.0%
machinery and equipment	47.8%	12.9%	31.8%	12.0%	6.4%	17.0%	26.0%	1.1%	0.2%	6.2%	0.0%
transport equipment	55.9%	12.0%	38.3%	15.0%	7.1%	22.2%	29.1%	1.0%	0.3%	6.3%	0.0%
instruments, clocks, etc	43.7%	13.7%	24.3%	11.2%	7.0%	8.4%	29.5%	0.0%	0.4%	6.9%	0.0%
Arms and ammunition	82.7%	15.0%	50.3%	9.2%	8.7%	38.7%	26.0%	0.0%	0.0%	8.7%	0.0%
miscellaneous manufactures	42.6%	13.7%	24.9%	6.7%	7.7%	4.6%	24.0%	1.2%	1.1%	5.9%	0.0%
art and antiques	61.0%	18.3%	30.5%	7.3%	8.5%	8.5%	32.9%	0.0%	0.0%	8.5%	0.0%

Some areas such as agriculture and weapons have high coverage. For these sectors, SPS, TBT, para-tariff measures, and other technical measures (e.g. pre-shipment inspection) are the most common NTM category. Arms and Ammunitions have the highest level of NTM frequency ratio in both TBT and Quantity Controlled NTMs. While as expected animals and animal products have the highest level of SPS NTMs. Stone, ceramics and glass face the least amount of NTM coverage, showing great disparity in results.

When looking at the specific price gaps estimates, the observed disparity for frequency ratios continues to be a trend. Theoretically, if a price gap equals to zero, it means that a country is paying world average prices for its products, but in these analyses, our results do not show this. The selected sample of countries in Figure 5 shows that extreme values for price gaps are prevalent: in a non-trivial number of cases (thousands of observations) some countries appear to be paying less than 20 percent (a value of -0.8) or more than 500 percent (a value of 4.0) of "world price". Figure 5 shows that at the median of these observations, a majority (68 percent) show negative price gaps values as high as -.52 (Nepal), while other countries such as Japan show price gaps of .44; none showed a price gap of zero. Estimated price gaps have many extreme values for every country. And due to the complex, not transparent or uniform method in which NTMs are compiled, it is difficult to identify what is driving each force; also, estimated price gaps have a remaining importer quality effect which must be addressed.

Figure 5: Percentile of Median Price Gaps Estimates, by Countries

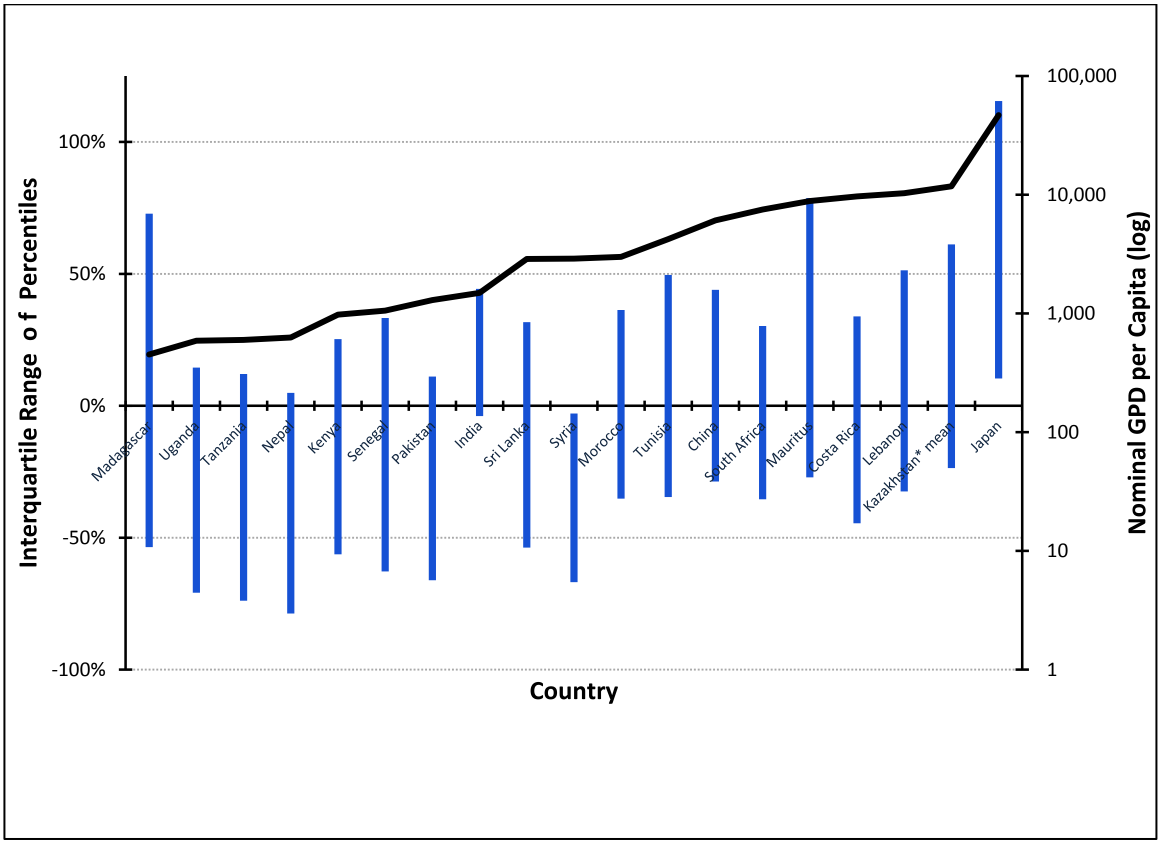
Country	p2.5	p5	p10	p25	p50	p75	p90	p95	p97.5	Per capita income
Madagascar	-0.93	-0.88	-0.80	-0.54	-0.05	0.73	2.86	7.05	17.92	451
Uganda	-0.95	-0.92	-0.86	-0.71	-0.36	0.14	1.20	3.08	7.84	589
Tanzania	-0.94	-0.92	-0.88	-0.74	-0.40	0.12	1.13	3.07	7.75	599
Nepal	-0.96	-0.93	-0.90	-0.79	-0.52	-0.05	0.49	1.58	4.42	626
Kenya	-0.93	-0.88	-0.79	-0.56	-0.17	0.25	1.40	2.98	6.65	977
Senegal	-0.94	-0.90	-0.85	-0.63	-0.22	0.33	1.69	3.96	7.90	1,057
Pakistan	-0.95	-0.92	-0.85	-0.66	-0.33	0.11	0.91	2.08	4.49	1,296
India	-0.91	-0.84	-0.73	-0.44	-0.04	0.37	1.37	2.94	5.98	1,492
Sri Lanka	-0.91	-0.87	-0.78	-0.54	-0.15	0.32	1.36	3.14	6.93	2,873
Syria	-0.93	-0.89	-0.83	-0.67	-0.41	-0.03	0.57	1.44	3.39	2,893
Morocco	-0.85	-0.75	-0.64	-0.35	-0.02	0.36	1.30	2.86	5.85	2,999
Tunisia	-0.87	-0.78	-0.65	-0.35	0.02	0.50	1.75	3.89	8.76	4,232
China	-0.90	-0.78	-0.62	-0.29	0.02	0.44	1.74	4.20	7.79	6,076
South Africa	-0.89	-0.81	-0.67	-0.35	-0.03	0.30	1.02	2.28	5.04	7,507
Mauritius	-0.87	-0.79	-0.62	-0.27	0.17	0.79	2.29	4.55	9.10	8,850
Costa Rica	-0.89	-0.83	-0.72	-0.45	-0.04	0.34	1.32	2.72	5.83	9,673
Lebanon	-0.87	-0.78	-0.64	-0.32	0.03	0.51	1.58	3.28	7.32	10,311
Kazakhstan	-0.85	-0.74	-0.57	-0.24	0.11	0.61	1.77	3.86	7.88	11,773
Japan	-0.61	-0.41	-0.16	0.10	0.44	1.15	2.63	4.66	7.82	46,736

While the preceding figures describe seemingly relevant data, it is difficult to account how many of the products each NTM really covers. For example, China, India, Nepal, Pakistan, and Sri Lanka report multiple policies for every NTM line. NTM frequency ratios show high numbers, but as the data collection is varied, it is not clear which NTM could be producing the change.

NTMs appear to raise import prices in many instances, but the country and sectorial potential NTM pattern is challenging to identify because data is not conclusive. This problem is pervasive when NTM price gaps are mass-produced by econometric methods (Ferrantino 2006). China shows that every line with an NTM, the NTM is both SPS and TBT. That said, it is not clear which NTM is affecting the product; it is assumed that if NTMs are lifted more trade will happen, but in this case, which NTM should be removed? Knowing that an NTM is present does not lead to price gaps estimates that show transparent gains or losses. Another discrepancy is that India does not report any SPS or TBT policies; and it is not clear why this is that case. With these anomalies, perhaps the consultancy effect played a role in producing anomalous data and results.

Results also show inconclusive data about quality effects. The literature review shows that *that higher-income importers are likely pay higher unit values* (Alessandria and Kaboski (2007), Co (2007), Ferrantino, Feinberg and Deason (2012)). This could be because higher income countries demand higher quality products, or because the price of services associated with these goods are higher in higher income countries; however, these theories are not captured in the price gap estimates. Results in Figure 6, show some level of correlation to relate to the estimated tariff equivalent; but correlation between price gaps estimates and per capita income vary.

Figure 6: Median Price Gaps and Log Nominal GDP per Capita



4. Analysis and Hypothesis Testing

Hypothesis Testing

With the assumption that price gaps are normally distributed, share the same variance, and each value is independently and randomly sampled, we ask: is there a significant difference of means in price gaps when NTMs are present? When testing the hypothesis that a positive price gap (or one that equals to zero) does not affect the difference of means in most of the countries selected in only one direction of the relationship, results show that although NTM do raise price gaps, the difference in means for most countries selected is insignificant as the resulting coefficients for most countries show mostly large positive changes. However, the treatment of outliers matters in achieving results.

Exploratory Regression Specifications

This first equation conditions the regression on factors such as HS section dummies and per capita income in 2012 and uses two alternate treatments for outliers: an OLS regression formula and a median regression with trimmed outliers. The OLS regression is as follows:

$$TE_{c,i} = \alpha + \sum_S \beta_S D_S + \sum_{c,S} \beta_{c,\,S}\, lnpci_c D_s + \sum_{\in(c,S)} \beta_{\in(c,S)} NTM_{c,i} D_{\in(c,S)}$$

This equation tests average NTM effects for countries (c) in one tail. $TE_{C,\,i}$ is the median of the estimated price gap from our preceding formula where the average NTM effects for countries (c) or HS sections (s) conditioning on HS section dummies and per capita income in 2012. Additional parameters are as follows: $_c$ is the country, s) represents HS sections, (i) are products at the HS6 subheading, and (D) is the dummy effect. The median regression is as follows:

$$TE_{c,i} = \alpha + \sum_S \beta_S D_S + \sum_{c,S} \beta_{c,\,S}\, D_c + \sum_{\in(c,s)} \beta_{\in(c,s)} NTM_{c,i} D_{\in(c,s)}$$

The specifications for the second model are the same, but average NTM effects for countries (c) or HS sections (s) conditioning on HS section and country dummies and $NTM_{c,i} = 1$ if UNCTAD reports an NTM. These equations are applied to both country and sector variation models.

Country Variation in NTM Effects

In the country variation results, coefficient estimates show extreme variation in value. If all factors are held constant only three countries show a negative difference from the mean: Japan, Kazakhstan, and Uganda. When looking at the *p*–value at the .05 significance, all values are positive and in almost all cases are at around five percent. These p-values remain positive with similar value trends at the .10 significance. Figure 7 shows that 12 countries out of 19 show *p*-values lower than 10 percent and others can be as high as 20 percent. In the majority of cases, *p*-values are higher than .05 which means we cannot automatically reject hypothesis; and thus consider the change in means coefficient insignificant.

Figure 7: Average Price Gaps (Ad Valorem Equivalent) Difference of Means Tests One Tail ([NTM=1]-[NTM=0]), 5 Percent Outliers Trimmed

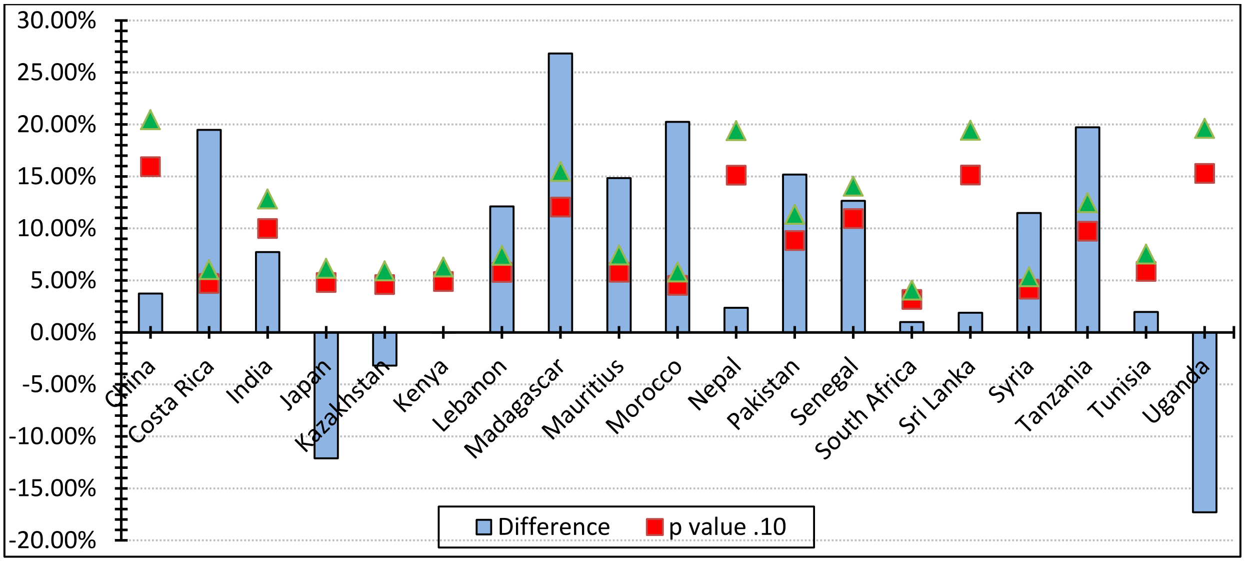
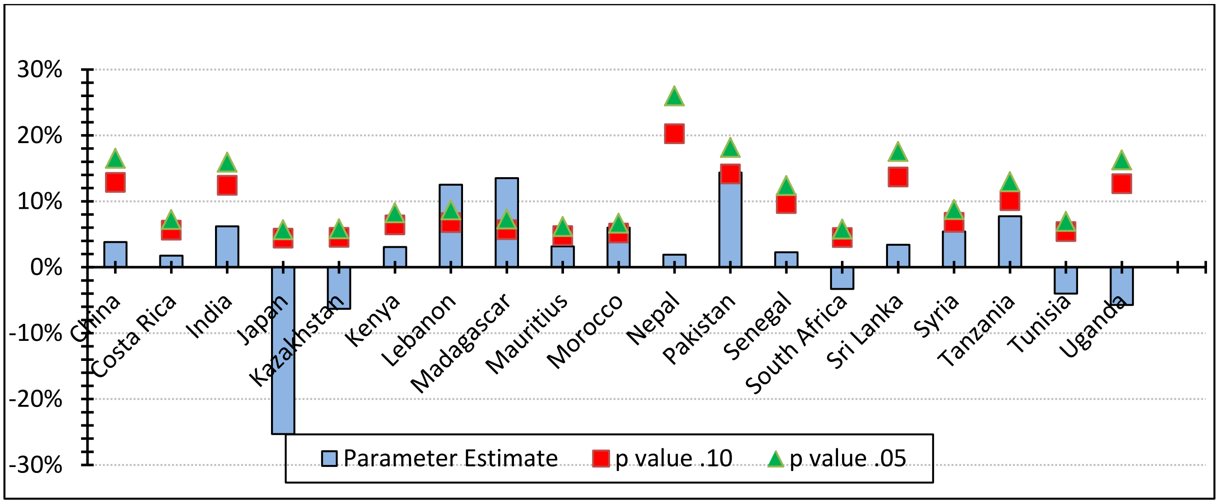


Figure 8 shows that with 5 percent of the outliers trimmed and conditioning the regression on sector and country dummies, five countries have negative difference in means coefficients**:** Japan, Kazakhstan, South Africa, Tunisia, and Uganda; and all other countries show a positive difference in means coefficients, all the coefficients are less than 20 percent. Negative coefficient values are not within the same range: Japan (-25 percent) is significantly more negative than the other countries. Since *p*-values at the .05 significance level are mostly higher than five percent, we cannot reject the null hypothesis. At the ten percent significance level, 14 out 19 countries show *p*-values lower than 10 percent, again demonstrating that the null hypothesis, cannot be rejected for all cases at the .10 significance level either.

Figure 8: Average Price Gaps (Ad Valorem Equivalent) Difference of Means Tests
5 Percent Trimmed Outliers, Conditioning on Sector and Country Dummies



The median regression in Figure 9 shows a similar pattern (to the previous regression) in the changes in mean, especially for Japan with its negative coefficient values. In the difference of the means coefficient, South Africa and Madagascar also show a negative value, but only six of the *p*-values are under at the five percent significance level, hence we reject the hypothesis and it is insignificant. Positive price gaps less than 15 percent with Sri Lanka, showing the largest difference of means coefficient and largest *p*-values. At the ten percent significance, the values are all under ten percent, that said these changes are significant at the .010, but not at .05 significance level, agreeing that a conclusive significant result could not be established.

Figure 9: Median Regression, Conditioning on Sector and Country Dummies

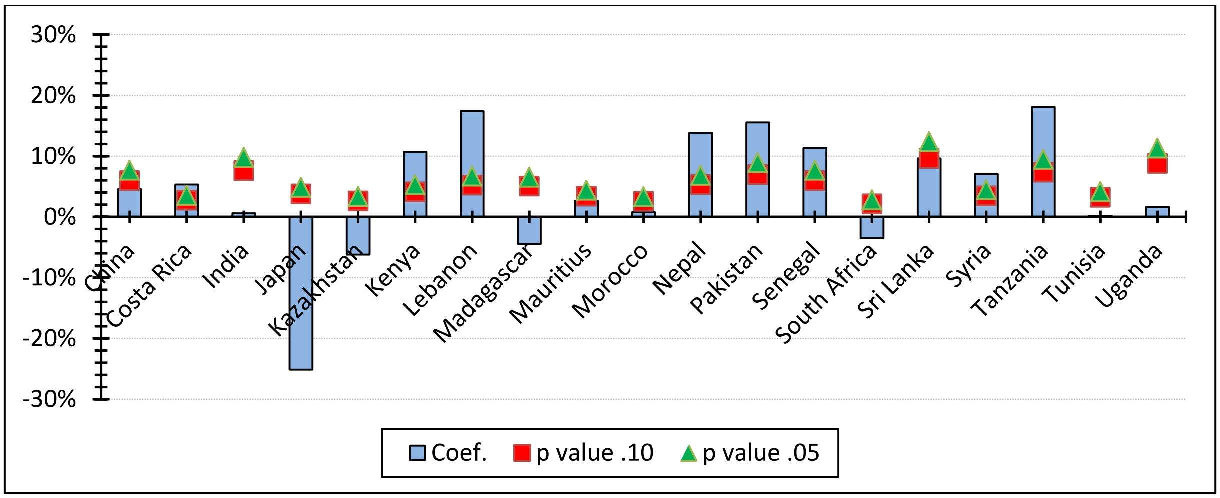
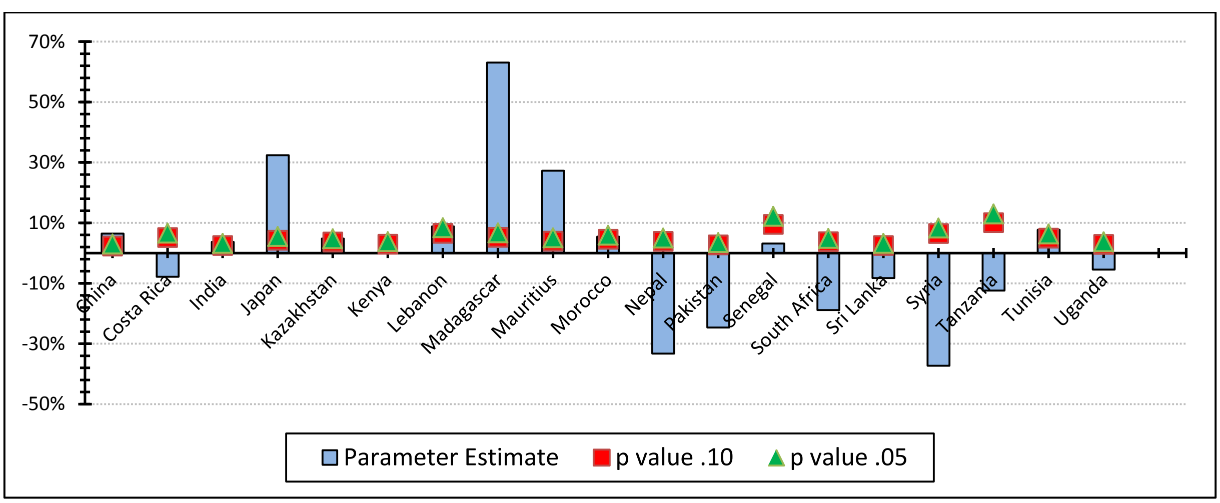


Figure 10 shows a regression where outliers are trimmed at the five percent level condition on Sector Dummies and per Capita Income while keeping all other factors constant and the results is even more varied. Here there are major differences in changes of mean. Nepal, Pakistan, South Africa, Sri Lanka, Syria, Tanzania, and Uganda show negative values

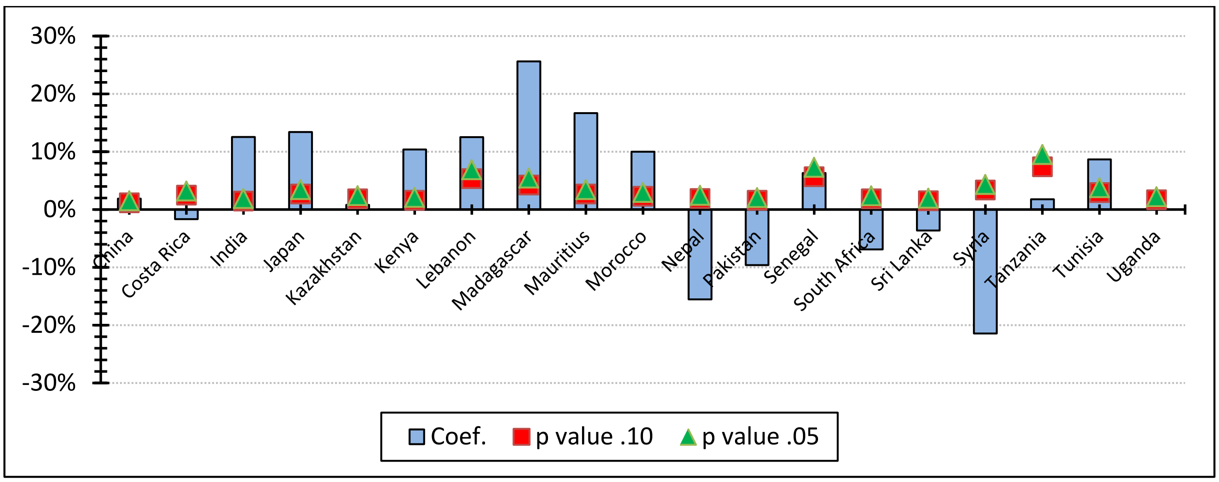
Figure 10: Five Percent Trimmed Outliers, Conditioning on Sector Dummies and per Capita Income



for the difference of means coefficient and most *p*-values are at around five percent, showing that at this level of significance the hypothesis could be significant, especially when almost all *p*-values are under the 10 percent benchmark. At this point, NTMs do affect price gaps for a number of countries; hence, the trimming of outliers does matter as it shows a difference in results.

Figure 11 shows a median regression conditioning on sector dummies and per capita income with results of varied coefficients for the changes in mean. That said when holding all factors constant, there are changes, but given the variability in frequency ratios, it is hard to identify the effects. The *p*-value at the .05 significance level in most cases is less than 5 percent meaning, we can reject the hypothesis, and at the .10 significance level p-values are under the .10 significance threshold, but the coefficient parameters are disperse and in most cases (13 out of 19) these are positive. For the sectors in which the coefficient effect is positive, we find that the *p*-values are very large; hence the positive effect is rejected.

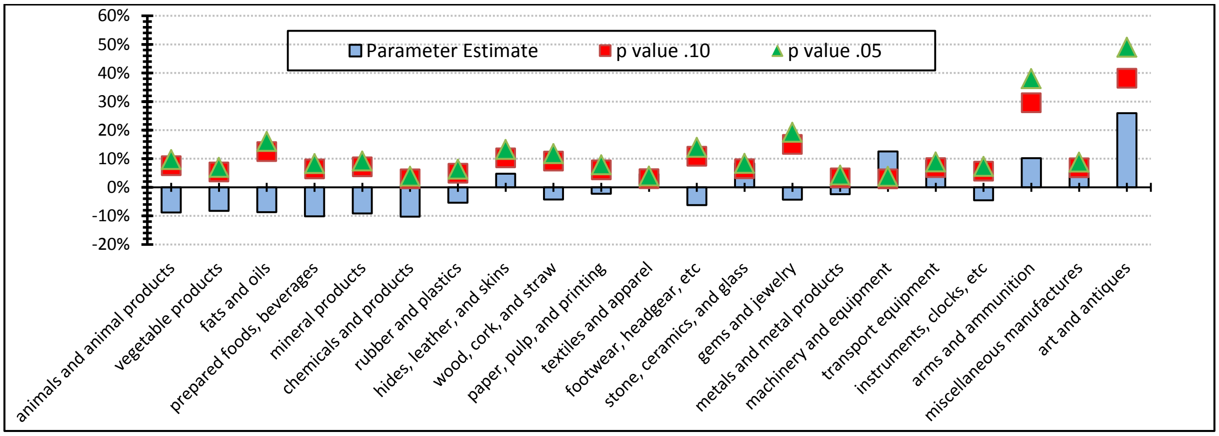
Figure 11: Median Regression, Conditioning on Sector Dummies and per Capita Income



Sectoral Variation in NTM Effect

Results for the Sectoral variation in the NTM effect continue producing varied results. Figure 12 shows HS-6 products grouped by sectors outliers are trimmed and all values are held constant except for sector and country dummies. *P*-values are much higher than the coefficient indicating insignificant values. They are higher than five percent, even when price gaps are negative.

Figure 12: Five Percent Trimmed Outliers, Conditioning on Sector and Country Dummies



In Figure 13, the median regression trims outliers, and conditions on sector and country dummies while keeping all other factors constant. The median regression shows that the coefficient parameters are mixed (9 positives, 10 negatives) and *p*-values and all vary in value. Again, results are not very clear, *p*-values are mixed and we fail to reject the hypothesis.

Figure 13: Median Regression, Conditioning on Sector and Country Dummies

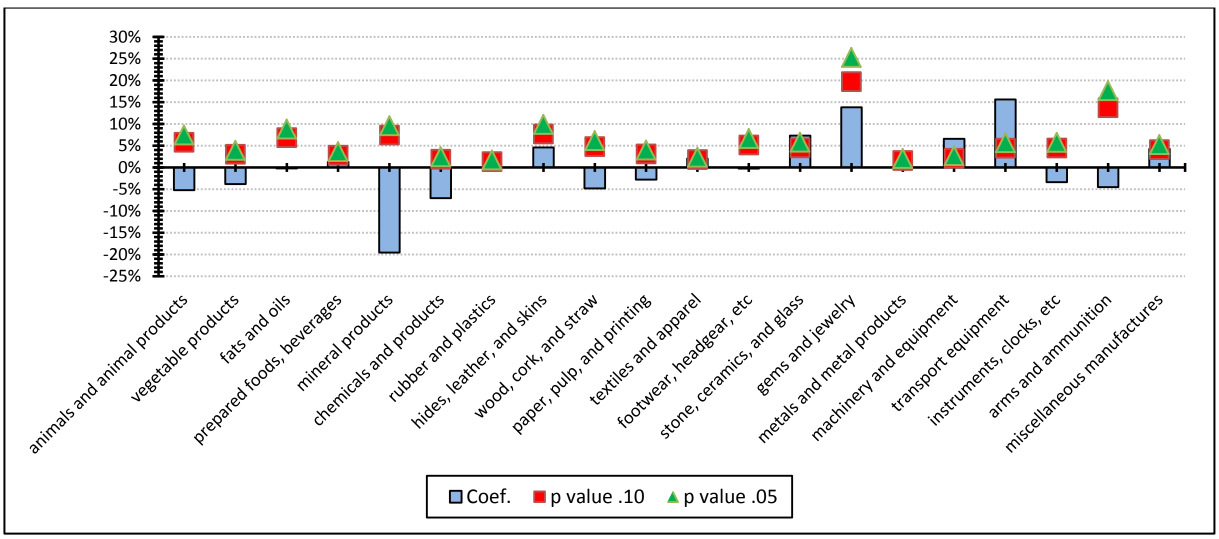


Figure 14 shows results for a regression with trimmed outliers, and conditioning for sector and capita per income. When outliers are trimmed, parameters yields mixed positive (8) and negative (11) estimates. However, in all cases the *p*-value is much higher than the estimates, indicating that failure to reject hypothesis, hence insignificant values. But as Figure 15 shows when the same theory is applied for a median regression, results are different: most coefficients are positive (12) and for the majority of results, the *p*-values are not higher than the parameter. *P*-values are low, but still higher than 5 percent, hence cannot reject the hypothesis and still consider values to be insignificant.

Figure 15: Five Percent Trimmed Outliers, Conditioning on Sector Dummies and per Capita Income

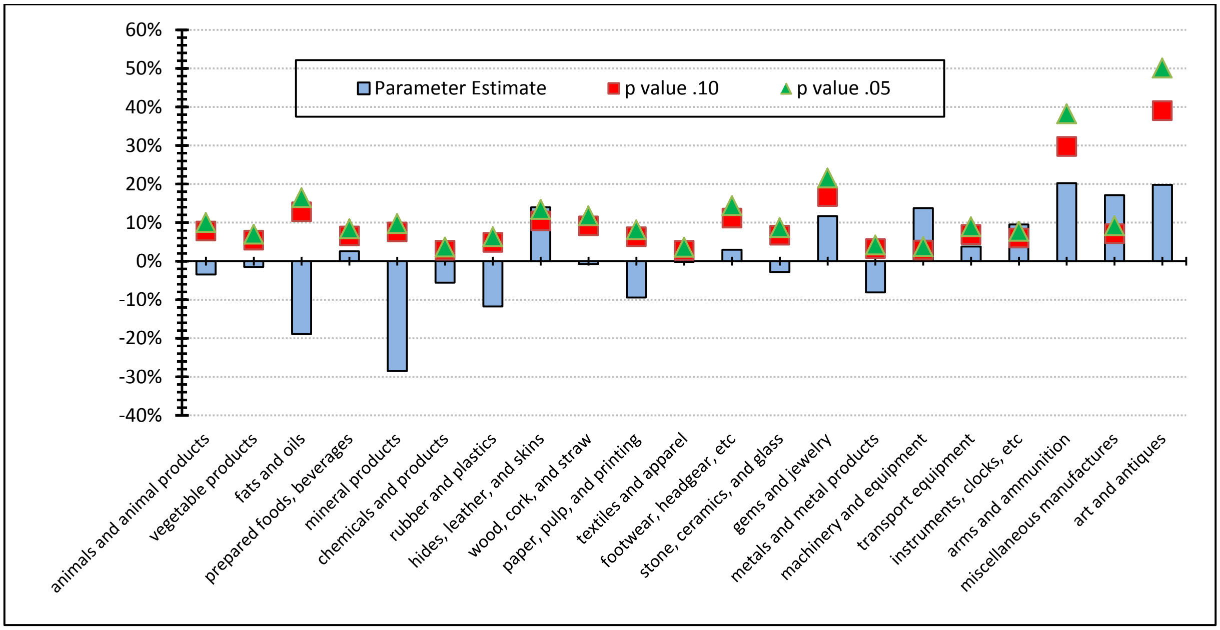
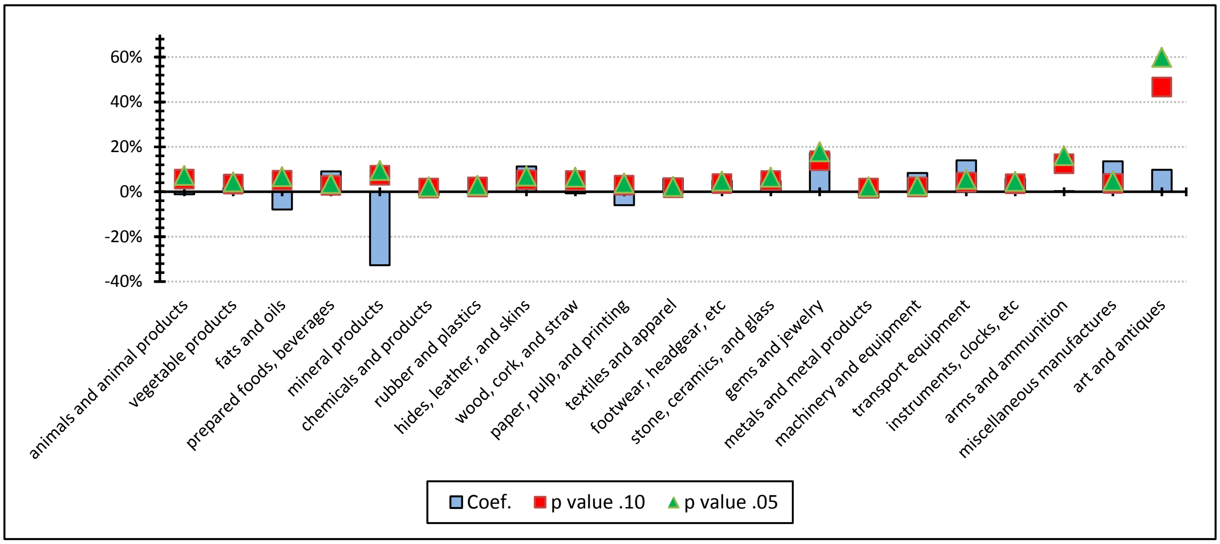


Figure 16 shows a median regression which conditions on sectoral dummies and per capita income. Results show that coefficients are mostly mixed (8 negatives, and 11 positives) and p-values remain mostly under 10 percent. That said, results that cannot reject the hypothesis and values are insignificant, which are a clear sign that more work or refined data needs to be used.

Figure 16: Median Regression, Conditioning on Sectoral Dummies and per Capita Income



Conclusion

Identifying the effects of NTMs is a challenging business. In subsequent work, the team hopes to compare results with those obtained by an econometric approach in order to identify the degree of robustness of estimated NTM price gaps to choice of method, and any variation in the degree of robustness according to product type, countries imposing measures, or type of measure. Also, it would be interesting to see which particular countries or sectors are having positive NTM effects. From our current results, we infer that it might be easier to identify NTM effects for countries than for sectors. In addition, it is clear that more specific data such as trade surveys could fine-tune results.

While this paper was not able to prove that there are significant quality adjusted TE estimates, it quantifies NTMs for the available data at the time; hence, it is a respectable starting point for the work that comes ahead. This paper also exposes the difficulties that researchers come across when studying NTMs, building on the information that *Quantifying the Trade and Economic Effects on Non-Tariff Measures* (Ferrantino 2006) proposes. Because it quantifies the amount of NTM exposure and the types of NTMs in the countries studied, this paper serves as a stepping stone to further research.

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