An Empirical Analysis of Tariff Binding*

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May 15, 2013

Abstract

Binding designed by WTO provides some countries trade policy flexibility and restricts some countries to low flexibility. Bindings vary a lot across countries and sectors. The Beshkar, Bond and Rho model, concerning the mechanism of setting optimal binding, yields some strong predictions and evidence within 66 WTO members. My paper is to further check whether their theory still holds using data from subsample and individual country. I expectedly find that bindings increase in political pressure, and decrease in market power and development level within 14 selected countries. The results are not robust to each individual country. Moreover, the results also support the theory that binding is independent of market power when market power is greater than a certain level. An additional finding is that weighted import concentration outside their theory also has a significant and negative effect on binding.

KEYWORDS: tariff bindings, commitments, WTO rules, trade agreements

*I am grateful to Mostafa Beshkar for giving me valuable advice. I also thank Le Wang for his helpful suggestion.

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1 Introduction

Currently, 159 out of the 193 countries in the world belong to the World Trade Organization (WTO). One of the WTO's purposes is to ensure a stable and predictable global trading system. Bound tariffs, which are specific commitments made by WTO members, are fit for this purpose. Bound tariffs are the maximum tariffs on goods, which are also called binding, ceiling or cap. Bindings are negotiated at the time countries join WTO or during trade rounds. Besides bindings, two other types of tariffs are Most-Favored Nation (MFN) applied tariffs and preferential tariffs. MFN is the most common actual tariffs applied equally to all WTO members. On occasion, countries impose preferential tariffs to partners if they are in the preferential agreement where countries give lower actual tariffs to others. The relationship among three types of tariffs can be visualized in figure (1).

From figure (3), bindings vary across sectors and countries, reflecting the underlying influence from lobbying sectors and different country-situations. If bindings are greater than applied tariffs, countries have the flexibility to increase their applied tariffs without breaking WTO rules. This flexibility is called binding overhang, the gap between bindings and MFN (figure (1)). Binding overhang leaves room for countries to increase tariffs when they face unexpected shocks such as import surges and political pressure. The larger the gap is, the more the trade policy flexibility exists, but the more uncertainty in the global trading system. Handley and Limão (2012) argue that the trade policy uncertainty reduces firm investment and entry into the export markets. This suggests that a large gap between binding and MFN impedes global economic recovery.

However, the WTO wants to maximize joint welfare of all members, reducing trade externalities as much as possible. The WTO sets different bindings to restrict the flexibility of some countries, but allows some countries to have the flexibility. Beshkar, Bond, and Rho (2012) theoretically and empirically predict that the WTO restricts countries with larger market power to lower bindings. It is reasonable that countries want to negotiate for high bindings in order to raise tariffs in the future if needed. The increase of tariffs can provide country tax revenue and increase the competitiveness of import-competing industries. But the increase of tariffs from a high market power country will generate more international externalities.

What motivates countries to set different bindings on products during each trade round negotiation? Beshkar et al. (2012) explain that governments will maximize tax revenues as well as benefits of consumers and producers under their political preference. The WTO will maximize the joint welfare for all governments by negotiating the optimal binding. They find that countries' market power importantly affects the binding during the negotiation.

Instead, Bagwell and Staiger (1999) argue that setting tariffs is irrelevant with WTO members' market power. That is because the WTO forces its members to internalize the international externalities which are prevailing when countries are free to set tariffs based on their market power. The Trade talk model in Grossman and Helpman (1995) also suggests market power does not play a role when countries negotiate optimal tariffs. They indicates countries set cooperative tariffs independent of market power. Moreover, the trade war model in Grossman and Helpman (1995) and Broda, Limao, and Weinstein (2008) confirm that market power would be an important factor when countries set optimal tariffs without cooperation. The protection for sale model in Grossman and Helpman (1994) points out the tariffs set by politically motivated countries can be affected by the factors such as import elasticity, import-penetration ratio, and political preferences. Maggi and Goldberg (1999) test this model that is consistent with the real data.

Some of the literature makes compares binding with MFN tariffs, and explains other factors of setting bindings. Bagwell and Staiger (2005) conclude that governments with uncertain political pressure under a self-enforcing trade agreement are more likely to set bindings above applied tariffs. Horn, Maggi, and Staiger (2010) suggest that contract costs might be the reason to have bindings above MFN rather than observed political pressure. Ludema and Mayda (2010) predict that bindings decrease in exporter concentration and market power.

This paper, based on Beshkar et al. (2012), empirically analyzes the determinants of optimal bindings because their paper explicitly models the mechanism of setting optimal bindings under WTO. In their model, not only market power but also political pressure are the key variables that explain the variation of bindings within 66 WTO members. This paper further examines the variation of bindings within their subsample that includes 14 selected countries and also provides results of each selected individual country. Since exporter concentration is another factor that can capture the free-riding problem in the trade negotiation, this paper also considers the effect of a new variable, weighted import concentration, on binding. I find that weighted import concentration has a significant and negative effect on binding.

Regarding the empirical part of binding in Beshkar et al. (2012), they find that market power and the political factor both significantly affect bindings, where bindings decrease in market power and increase in political pressure. They use two measures of market power, one is import share and one is inverse of export elasticity. When using import share, they use the IV method to correct the endogenity problem and two way clustering to get precise standard error. When using inverse of export elasticity, they use country dummies to capture country variation. They also group the countries by whether they are new WTO members or not, and by sectors, manufacturing or agriculture.

This paper first examines whether their original model holds within the subsample and finds support, then adds one more variable to the model to see whether weighted import concentration also plays a role in setting bindings. This paper finds import share is not a better choice to measure market power after adding this new variable. This paper not only uses country dummies but also uses sector dummies to capture the industry effects such as sectoral political pressure which is not easily observed, where the results are consistent with the expectation. The paper also groups the observations by the level of market power measured by GDP and inverse of export elasticity and the results support the theory that bindings are independent with market power when market power is greater than a certain level. However, the results from individual countries vary a lot and most of them are not significant and have different signs. Only Japan, India, and Turkey have the expected results. This suggests the model for each country might be different.

Section 2 presents the econometrics method and its motivation. Section 3 describes the data set used. Section 4 discusses the empirical results from countries and each individual country. Section 5 concludes.

2 Model

2.1 Optimal Binding

This section provides the theory of optimal tariff binding based on Beshkar, Bond, and Rho (2012) to motivate my empirical analysis. According to Beshkar et al. (2012), a political welfare maximizing importing country wants to maximize the welfare V summed by consumer surplus, producer surplus, and tariff revenue. Its producer surplus is politics-weighted because such government cares its import-competing producers with a certain weight called political preference θ for those industries. Its trading partner's corresponding welfare V^* will be the sum of relative consumer surplus and relative producer surplus. By solving the maximum domestic welfare, Beshkar et al. (2012) get non-cooperative tariff

$$t^N = \frac{\eta\omega + \theta}{\eta - \theta} \tag{1}$$

where ω is the inverse of export elasticity that captures market power, and η is import elasticity * import penetration ($\varepsilon * \frac{m}{y}$). Inverse of export elasticity is $\omega = 1/(\frac{dx/x}{dp^*/p^*})$, where x is exports and p^* is the foreign price. Import elasticity is $\varepsilon = \frac{dm/m}{dp/p}$, m is imports, and y is domestic output. Take second order derivatives, we know unilateral tariffs increase in political pressure θ and market power ω, but decrease in η when political pressure θ is not so high ($\theta < \eta$). If θ is too high, then t^N will prohibit trade. Mathematically,

$\frac{\partial t^N}{\partial \eta} = \frac{\omega^2}{\eta(\eta-\theta)} - \eta^{-2} < 0$. Intuitively, the increase of tariff will increase the price of imports. A little increase of price will heavily reduce imports if $|\varepsilon|$ is high. Then government loses tariff revenue and consumers pay more to buy the good. Since import decreases, import penetration becomes smaller. So country will reduce tariff when import elasticity is high and import penetration is high. By solving the maximum joint welfare $W = V + V^*$ of both countries, they get the cooperative tariff $t^E = \frac{\theta}{\eta-\theta}$.

Optimal binding on goods is from negotiation under WTO rules where binding is the maximum MFN rates. Countries cannot impose MFN above binding. Countries negotiate binding with uncertain political pressure θ that bound in the interval of $[\underline{\theta}, \overline{\theta}]$. With binding, countries can increase their MFN rates t^N as political pressure increases, but to the ceiling of binding at the political pressure θ^B, where $t^B = t^N(\theta^B)$ and we can derive the threshold

$$\theta^B = \frac{(t^B - \omega)\eta}{1 + t^B} \tag{2}$$

The optimal binding t^B under WTO rules is designed to prevent countries imposing too large MFN, at the same time allow countries to have flexibility, overall maximize the expected joint welfare $E[W]$ for all members. This yields a condition $\frac{t^B}{1+t^B} = E[\theta|\theta > \theta^B]$ when $\theta > \theta^B$ and corresponding optimal binding formula:

$$t^B = \frac{E[\theta]}{\eta - E[\theta]} \tag{3}$$

Suppose political pressure is $\underline{\theta}$ now. If $\underline{\theta} > \theta^B$, country can only impose MFN at binding t^B. In this case, solving inequality (1) > (3), we have $\omega > \frac{E[\theta]-\theta}{\eta-E[\theta]}$. This suggests when market power is greater than a certain level, country will not have overhang which provides flexibility for countries to increase tariff in the future if needed. The optimal binding is (3) which is independent of market power. If $\underline{\theta} < \theta^B$, country can impose MFN rates t^N any time without any cost, then optimal t^B falls in $[(t^N(\underline{\theta}), t^N(\overline{\theta}))]$ and increase in the interval of political pressure $[\underline{\theta}, \overline{\theta}]$. The question is what factors impact the optimal binding to be lower or higher in this interval when $\omega \leqslant \frac{E[\theta]-\theta}{\eta-E[\theta]}$.

Market power ω is the most important factor in the Beshkar et al. (2012) theoretical model. They have a strong prediction that binding decreases in market power if market power is below a certain level. They also empirically support this prediction within 66 WTO members. My main purpose is to test whether it still holds for individual country. Intuitively, a country with high market power is more able to gain from a tariff. For example, if China imposes a tariff on cotton, exporters cannot easily reduce the exports to China. If Uruguay imposes a tariff on cotton, exporters will easily export somewhere else. From(1), a country with high market power imposes higher tariffs. Given an optimal binding and equation (2), this country with higher tariffs will have lower θ^B. Lower θ^B means lower binding from equation (3). Normally, there are three ways to measure market power. Pelc (2013) uses GDP and log GDP to measure the market power when he estimates the effect of overhang on applied tariffs. Broda et al. (2008) use inverse of export supply elasticity as market power to measure the relationship between market power and optimal tariffs. Beshkar et al. (2012) also use import share and they explain that import share and inverse of export supply elasticity are positively correlated. They are positively correlated within 66 members even though they are not in the subsample 14 countries in table (3). Inverse of export supply elasticity is estimated and capture the variation of market power across goods in a country. Import share is the ratio of imports over world imports, so it can be a better measurement of market power across goods within countries. Accordingly, I use export supply elasticity when testing the theory across sectors by country.

Other factors in Beshkar et al. (2012) model are political pressure θ, η, and GDP per capita (cgdp). As explained above, binding always increases in political pressure. GDP per capita is similar to market power that a big country has lower binding. The effect of η differs from ω. First, the increase of η will increase θ^B in equation (2), which will positively affect binding by equation (3). But, in (3), the increase of η also has a negative effect on binding. Thus, the effect of η is not clear, which depends on the magnitude of changes on η and other variables in the equations.

Explanatory variable weighted import concentration ξ is the main difference of my paper and Beshkar et al. (2012), which is expected to have potential negative effect on binding. Rho (2013) explains import concentration can measure the import market structure. Here, ξ is trade-weighted import concentration, using data imports as weights. Negotiation is costly because it takes time and gives rise to the free-riding problem. Free riding comes from the nature of MFN tariffs that equally applies to every WTO member. When one country successfully negotiates a lower binding with another country, then others can also enjoy the same MFN. This suggests countries do not want to negotiate the binding frequently, and they probably re-negotiate the binding when their economy really in a bad situation. Or, there is another situation. If country A only imports cotton from country B, then country B is more likely to force country A reduce the binding on the cotton in the trade round negotiation without free-riding problem. Import concentration captures this situation. It can be calculated as $H = \sum_{i=1}^{N}(s_{ij}^{k})^2$, where s is the import share of exporting country i in importing country j in sector k. If $H = 1$ on cotton, then importing country j only has one exporter of cotton. If importing country j faces two exporters who share the market equally, then $H = (\frac{40}{80})^2 + (\frac{40}{80})^2 = 0.5$, where they both exports \$40 to country j. The lower the import concentration is, the more exporters the country j faces. When country j has the maximum level of $H = 1$, it has the pressure to reduce the binding in the negotiation. Thus, the relationship between import concentration and binding should be negative. However, negotiation also takes time, so even if the exporter is monopoly in country j, it may not want to re-negotiate the binding on cotton if its exports are not sufficient large. In this case, we might want to multiply H by the imports on cotton to measure the situation that whether exporter wants to re-negotiate a lower binding. This measurement is ξ = import concentration * imports. If ξ is sufficiently large, then exporter wants to re-negotiate a lower binding. It is the same for the two exporters case, and so does the N exporters case. Thus, the expected effect of ξ is that binding decreases in ξ.

2.2 Estimation method

My empirical analysis builds on the mechanism of setting optimal binding from Beshkar et al. (2012) model. They estimate the theoretical model across sectors within 66 WTO members. To see whether their theory still holds for individual country, and whether the above analysis is consistent with the real data within subsample 14 selected countries, I estimate the following equations by Tobit model. The first one (4) is binding across sectors k at HS 3-digit within countries j. The second estimation equation(5) is binding across sectors k by individual country.

$$t_{kj}^{B*} = \beta_0 + \beta_1 f(\omega_{kj}) + \beta_2 \eta_{kj} + \beta_3 \theta_j + \beta_4 f(cgdp_j) + \beta_5 \xi_{kj} + \varepsilon_{kj} \tag{4}$$

$$t_{k}^{B*} = \beta_0 + \beta_1 f(\omega_{k}) + \beta_2 \eta_{k} + \beta_3 \xi_{k} + \varepsilon_{k} \tag{5}$$

$$t_{kj}^{B} = \begin{cases} t_{kj}^{B*} & \text{for} \quad t_{kj}^{B*} > 0 \\ 0 & \text{for} \quad t_{kj}^{B*} \leq 0 \end{cases}$$

where t_{kj}^{B} is observed binding on sector k by country j in the trade agreement and t_{kj}^{B*} is latent variable. The reason why use Tobit is that some goods are unbound so the binding on these goods is zero, which means dependent variable binding is censored below zero.

The first concern of equation (4) is that industries in different countries face different economic issue and environment. Cross-country differences in binding on sectors may be formed by these variations. For example, a given country that is in the period of their political instability tend to want higher binding. Since country dummy is to capture the effect of these country-characteristics that similarly affect all industries in a country, I include two country-level variables political instability index and GDP per capita instead of country dummy in column 2 in table (4a) to capture these effects. For comparison, I also have regression in column 4 in table (4a) includes country dummy without country-level data. Moreover, it is reasonable to believe that country characteristics will affect industries in a different manner. For instance, a typical tobacco country may want higher binding on their tobacco products because they are abundant at this natural resource and do not need too much imports. Tobacco industries in such countries get more attention and welfare due to the country policy. We may want to include such country characteristics interacting with industries, which is motivated by Mayda and Rodrik (2005) who analyze individual data across countries.

The second concern is the endogenity in international trade because I use import share as market power and import penetration. Production and imports depend on tariff levels. Many people test the effect of tariffs on trade volume. And some researchers also test the effect of trade data on tariffs. Bagwell and Staiger (2011) test the effect of trade volume on tariff cuts. Beshkar et al. (2012) use GDP and per-capita endowment of productive capital, natural capital, and natural minerals as instruments for import share which is motivated by factor content theory in Romalis (2004). Beshkar et al. (2012) suggest that the results from IV Tobit and Tobit are almost the same. One reason might be that our dependent variable is not a tariff but a binding which is almost fixed at the beginning and do not easily change associated with the changes of imports or production. So my model does not use IV method.

3 Data

The previous section examines the factors affecting optimal binding and the econometrics approach. This section explores these variables in the real data. In order to estimate determinants of binding, we need data on tariffs, trade, production, elasticities, GDP, and political pressure.

The data includes 14 countries: USA, China, Japan, Canada, Korea, Thailand, Malaysia, Turkey, India, Peru, Brazil, Uruguay, Colombia, and Chile. They were chosen not only because their data is available but also because they are heterogeneous by any trade measure. Their variation can be seen as different binding level, overhang, country size, GDP, location, openness, and membership of other trade group such as Free Trade Agreements (FTAs). The

US has bilateral FTAs with Chile and Peru. Data does not include countries from Africa and EU. But EU is similar to US because it has low binding and almost zero overhang. So influences about binding across these countries might be generalized except for countries from Africa. Table (1) summarizes characteristics for each country. Figure (2) shows the average tariffs level by country. Japan, China, Canada and the US almost have zero overhang and very low binding. India has high overhang and binding.

Binding variation within each country is more complicated. Figure (3) describes the frequency distribution of binding within country at HS 3-digit level. Most country has sufficient variation across sectors except for Chile, Peru and US. The structure of binding for each country is unique even though they are almost below 50 and close to zero, which means binding is censored at zero. But some countries such as India, Korea, Thailand, Colombia, Turkey, and Malaysia still have some bindings above 100. These different distributions suggest that countries might have other concerns when setting optimal binding. A particular country might not set their binding driven by their market power as we expected because the government is risk averse and fears retaliation. This suggests we should expect various results when running the same regression by individual country.

Data set is cross-sectional data in year 2007. Binding is set at the time of WTO found in year 1995. Many countries reduce their tariffs since 1995 to meet the binding obligations. This phase-in period ends around 2006 for most members. Since the theoretical model neither includes this effect nor focuses on serious economic shocks such as financial crisis of 2008, year 2007 is better used to analyze binding.

Most data is from Beshkar et al. (2012). Their dependent variable tariff binding and other tariffs are from WTO(2010) at 6-digit HS level, and it is aggregated as 3-digit HS code by taking simple average to match other variables. Key variable market power measured as the inverse of foreign export supply elasticity ω is from Broda and Weinstein (2006) at 3-digit HS level, and so does import elasticity ε. Import share can be calculated from UN Comtrade database (United Nations Commodity Trade Statistics Database). Import penetration $\frac{m}{y}$ is calculated by matching production data y from UNIDO (United Nations Industrial Development Organization) to import data m from UN Comtrade at 3-digit HS code. Since output data is limited to certain ISIC sectors where most of them are manufacturing and they are much less than HS 6-digit sectors, many observations were dropped after using this variable $\eta = \varepsilon \frac{m}{y}$. GDP (2000 constant US million \$) and GDP per capita(\$) are obtained from World Bank database. Unfortunately, we do not have data to measure sectoral political pressure. The better proxy should be unemployment rate in each sector which is not obtainable. So we use country-level data political instability index that comes from the Economist's Intelligence Unit data in 2007. Import concentration can be calculated using the equation defined above and data from UN Comtrade. Trade-weighted import concentration ξ (billion\$) = import concentration * imports (billion\$).

Table(2) reports the descriptive statistics for variables. Binding has mean 22%, median 20%, and maximum 299%, so it might has outliers. Figure (4) also portrays some outliers. I use DFBETA command in Stata after OLS reg to find out the outliers. But it might not be suitable to drop them even though the regressions perform better after that. For example, Korea had the highest binding 299% on milling industry products and India had second highest binding 280% on vegetable oils. It is not a surprise that Korea and Indian had such high bindings. They had higher bindings on other products in 2007 which are not reported here due to the limited data on production data. Moreover, The standard deviation of omega and GDP/c is very large, so I use their semi-log specifications in my regression to correct their skewness which is motivated by a lot of literature (Beshkar et al. (2012), Broda et al. (2008),etc.), where $f(\omega_{kj}) = log(\omega_{kj})$ and $f(cgdp_j) = log(cgdp_j)$.

4 Results

4.1 Baseline results

Table (4a) and (4b) show the results for equation (4) within 14 countries. The first column without new variable ξ verifies the theory in Beshkar et al. (2012): market power and GDP per capita have negative and significant (at 1% level) effect on bindings, political pressure has positive and significant (at 1% level) effect on bindings, and η is not clear because of its insignificant and about zero magnitude.

The second and third column are the baseline results of equation (4). First, both two market power measurements inverse of export elasticity and import share have negative and significant (at 1% level) effect on binding, and import share has larger coefficient. A one-standard-deviation (0.063 reported in table (2)) increase in import share reduces the tariff binding by 3.6 (0.063*56.61). But this numerical effect may not reliable because the new variable weighted import concentration ξ is not significant in the regression using import share, but significant and has the expected negative sign in the regression using ω. One possible reason is ξ and import share both related to imports which drive larger coefficient of import share and insignificant of ξ. The effects of η, political, and GDP per capita are all similar in the first three columns. The effects of ω are similar in the regressions with and without new variable ξ. These suggest the inclusion of ξ does not greatly improve the overall fit of the regression, where Pseudo R^2 is almost the same. But ξ does play a significant role in influencing binding.

The last two columns in table (4a) are presented regarding to the concern of country-specific effect and industry-specific effect which are explained in section 2. In column (4), including country dummy without country-level variables, the results are similar. In column (5), including sector dummy defined by section (table (6)) which might capture the sectoral political pressure that does not have data yet. The results are similar comparing to the baseline result in column (2).

Another concern is about Tobit model which has assumptions that heteroskedasticity and non-normality result in inconsistent Tobit estimator. Although I report robust standard error in parentheses, but the results are very close with the same sign and significant level when excludes robust standard error expect for regression (4) with country dummy. Thus, for other regressions in table (4a) seems no heteroskedasticity.

Table (4b) presents other regressions as robustness checks on our expectation. The first two groups in columns (6)-(9) are designed to examine the theory that binding is independent of market power ω when ω is larger than a certain level. Since GDP can be measured as market power too, I include both of them to test this theory. In terms of GDP, I group the countries by high GDP and low GDP. According to table (1) whose countries are sorted in decreasing order of GDP, GDP is large until Korea and is relative lower starting from Turkey. So high 7 in column (6) refers to top 7 countries in table (1). In column (8), top 33% of omega includes the observations that are in 33% maximum of omega. The results are consistent with the theory because the effect of market power is not significant on binding when market power is larger, but it is significant and negative when it is lower.

The last two groups in table (4b) are sector and region which are expected to further capture industry-specific effect and the country-specific effect on location. There are two differences between agriculture sector and manufacturing sector, one is market power and another is political pressure. Manufacturing sector has the expected results while agriculture does not. The reason might come from the data. When we use production data, many observations from agriculture were dropped since production data is not available to most agriculture goods. The stories of different regions Asia and South America are more complicated. Asia countries include Japan, China, india, Korea, Thailand, and Malaysia. South America includes Brazil, Chile, Peru, Uruguay, and Colombia. On average, South America has lower market power than Asia which explains market power is significant negative in South America but insignificant negative in Asia, supporting the theory again. Interestingly, binding significantly increases in other factors (political pressure, development level, and import concentration) in South America. It seems reasonable because South America relies less on the export than the world average so that they are not afraid of retaliation and have rich natural resources. Free Trade Agreements (FTAs) among them and their smaller binding variation might be other reasons that account for these differences.

4.2 Individual country results

The individual country results are different and inconsistent with the baseline results in many cases. Each country has its story so that model for a particular country seems to omit more potential variables. To carefully explain the determinants of binding for a given country requires its own paper. But, individual country results presented in table (5a) and (5b) still provide some support for the theory. Countries are sorted in decreasing order of their 2007 GDP. Table (5a) includes top 7 GDP countries and table (5b) includes others. The model does not include sector dummies because sample size for each country is small even though countries like Brazil, Canada, China, India, Japan, Thailand, Uruguay, Malaysia, and Turkey have binding variation across sectors. The small sample size is also a problem for analyzing these results.

From table (5a) and (5b), only three countries Japan, India, and Turkey are consistent with the baseline results. One reason should be they have larger variation of binding. But China and Canada also have larger binding variation and their results are different. The effect of η that stands for domestic cost of tariff distortions is still not clear on binding overall. Some countries like US, Japan are significantly positive. Some countries like China, India, Korea, Turkey, Thailand, and Peru are significantly negative. The new variable weighted import concentration is negative expect for Chile and Peru, and significantly negative in some countries like Japan, China, India, Turkey, Thailand, and Malaysia. More important, market power has negative effect on many countries even though some of them are insignificant.

5 Conclusion

The purpose of this paper is to empirically analyze the variation of tariff bindings. The paper is based on the methodology of Beshkar et al. (2012) and adds one more variable motivated by Ludema and Mayda (2010). Because some factors of bindings are hard to observe and measure, some are country specific and some are industry specific, the paper tries to use different perspective to see whether the theory still holds under different conditions and also provides individual country evidence. The paper finds that bindings decrease in market power, level of development, weighted import concentration, increase in political pressure and is not clear in the domestic cost of tariff distortions. However, the results are not robust when grouping data by regions. The reason might be the potential effects of preferential agreements prevailing in the regions. The results also vary a lot for each country, which is what we expected because the situation for each country is different. So a particular case may not be used to test the general theory.

Even though the empirical work is motivated by rigid theory, there are other possible issues when relaxing the assumption that countries only negotiate bindings in the agreement. Other trade policy instruments might account for the variation of bindings. For example, free trade agreement might be one of the reason that explain the difference of South America. In terms of the estimation methods and data collecting, estimated elasticity might cause errors, small sample size for each country is a problem, and the assumptions of Tobit model should be verified.

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Appendix A. Data Description

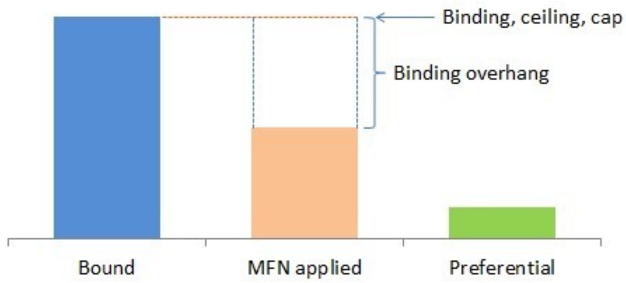

Figure 1: Three types of tariffs and overhang

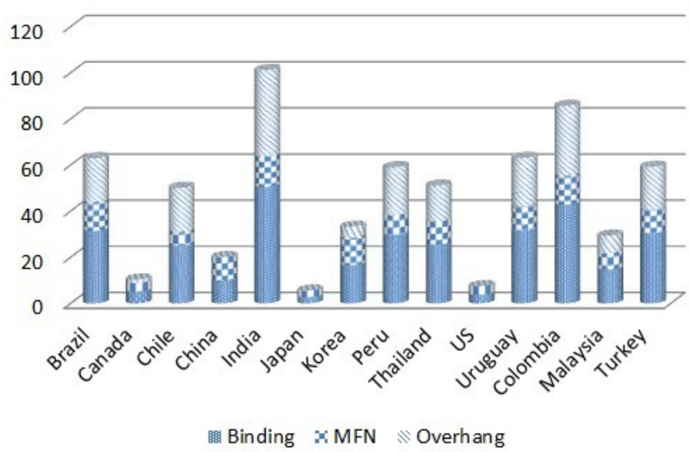

Figure 2: Average tariffs across 14 countries

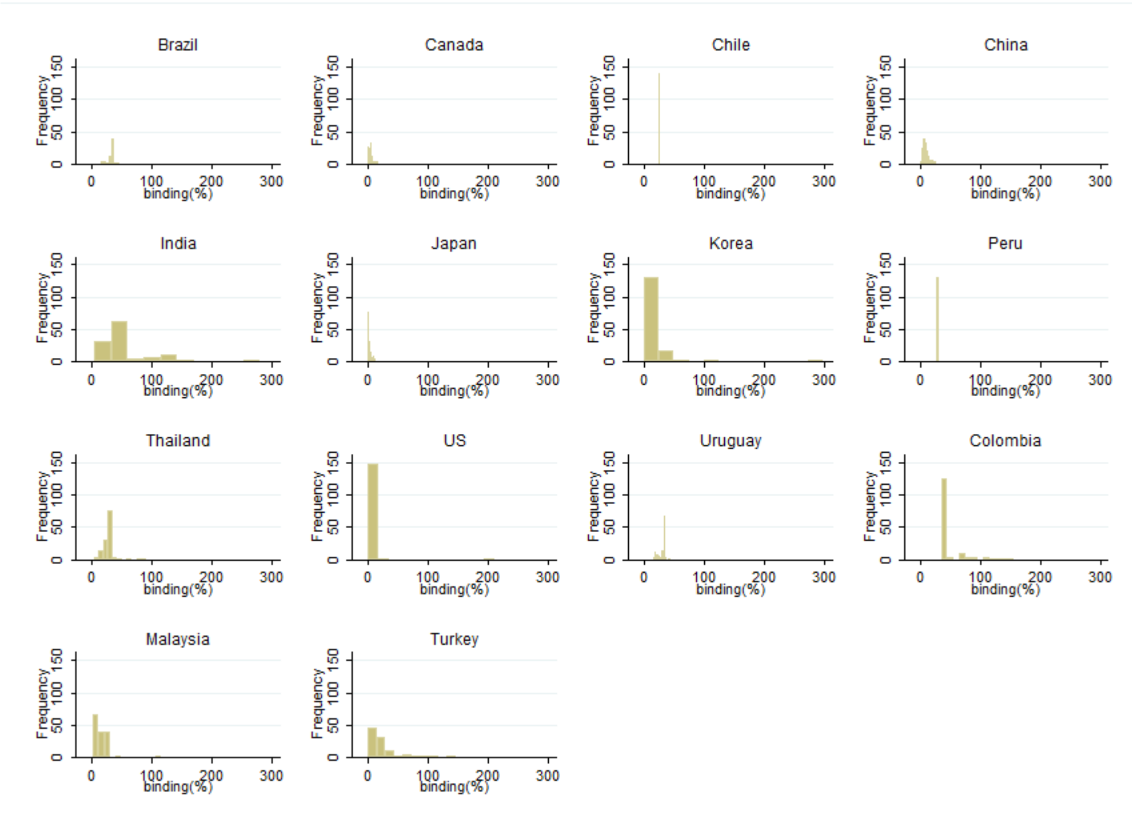

Figure 3: Binding distribution by country

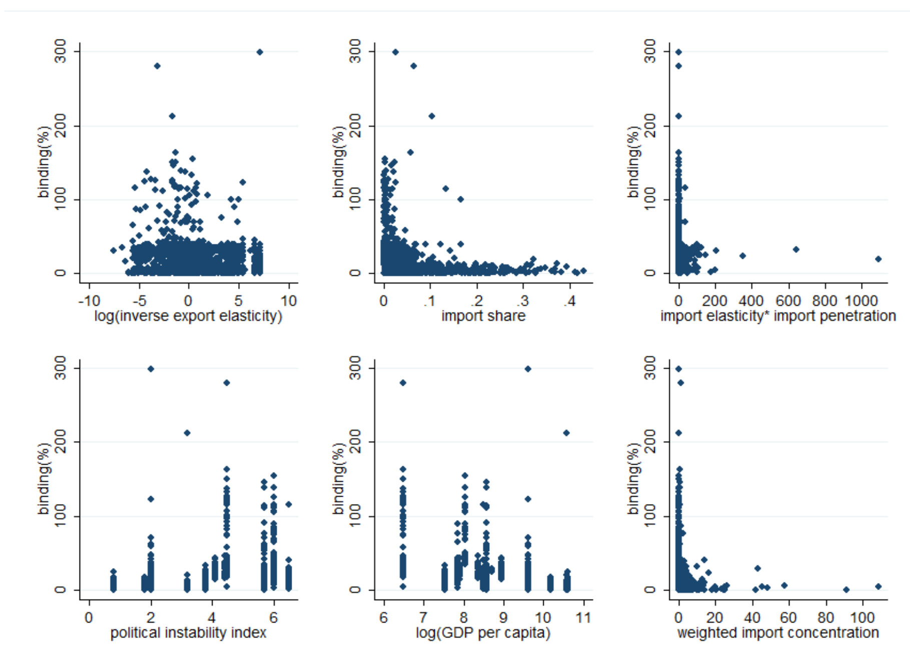

Figure 4: Scatter plots of binding against variables

Table 1: Country description

Country	ISO3	N	GDP(bil$)	cgdp($)	political	joint WTO
US	USA	150	11468.00	38744	3.2	1 January 1995
Japan	JPN	152	5202.70	40707	0.8	1 January 1995
China	CHN	153	2387.68	1864	3.8	11 December 2001
Canada	CAN	142	869.29	26230	1.8	1 January 1995
Brazil	BRA	60	812.57	4298	4.4	1 January 1995
India	IND	120	771.09	659	4.5	1 January 1995
Korea, Republic of	KOR	152	734.48	15158	2	1 January 1995
Turkey	TUR	101	373	5324	5.7	26 March 1995
Thailand	THA	133	173.64	2563	6	1 January 1995
Malaysia	MYS	148	132.99	4926	6.5	1 January 1995
Colombia	COL	151	131.09	3083	6	30 April 1995
Chile	CHL	147	101.18	6078	4.1	1 January 1995
Peru	PER	142	76.75	2726	6	1 January 1995
Uruguay	URY	118	26.91	7685	4.1	1 January 1995

Table 2: Descriptive statistics

Variable	Obs	Mean	Median	Std.Dev.	Min	Max
binding(%)	1869	22.03567	20.20938	22.57959	0	298.7852
import share	1869	0.038905	0.014381	0.062937	0	0.429986
ω	1869	56.7039	1.055279	212.8903	0.00051	1254.492
$\log(\omega)$	1869	0.401874	0.053805	2.725158	-7.5811	7.134486
imp.elas.ε	1869	6.292391	3.111299	22.91054	1.074257	821.8975
imp.penetration. $\frac{m}{y}$	1869	0.963695	0.337565	4.127675	0	142.8759
$\eta = \varepsilon \frac{m}{y}$	1869	5.540368	1.054487	33.12998	0	1090.016
imp.con.	1869	0.58606	0.575596	0.137901	0.196601	1
imports(bil.$)	1869	2.047426	0.259	8.116093	0	206
w.imp.con ξ	1869	1.118214	0.145189	4.673013	0	108.427
GDP(bil.$)	1869	1831.464	372.6193	3232.848	25.54496	11670.85
GDP/capita($)	1869	12258.14	5324	13741.46	659	40707
log(GDP/c)	1869	8.764446	8.57998	1.174763	6.490724	10.61416
political θ	1869	4.134189	4.1	1.774698	0.8	6.5

Table 3: Correlation between variables

	binding	imshare	lomega	η	ξ	lcgdp	pol
binding	1						
imshare	-0.3325	1					
lomega	-0.082	-0.0126	1				
η	-0.0016	-0.0378	0.1003	1			
ξ	-0.1463	0.3576	-0.027	-0.0045	1		
lcgdp	-0.4924	0.3706	-0.0452	-0.0238	0.137	1	
pol	0.3949	-0.3408	0.0684	0.0389	-0.1459	-0.7088	1

Appendix B. Results

Table 4a: Tariff binding across sectors within countries

	Dependent variable: Tariff Binding				
	Baseline			Fixed Effects	
	original	All	All	country	sector
	(1)	(2)	(3)	(4)	(5)
$\log(\omega)$	-0.92***	-0.93***		-0.46**	-0.61***
	(0.22)	(0.22)		(0.22)	(0.23)
$\eta = \varepsilon \frac{m}{y}$	-0.00	-0.00	-0.01*	-0.01**	0.01
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
political	1.59***	1.48***	1.10**		1.51***
	(0.45)	(0.45)	(0.45)		(0.42)
log(GDP/c)	-8.59***	-8.49***	-7.79***		-8.52***
	(0.87)	(0.87)	(0.90)		(0.78)
w.imp.con.		-0.39**	-0.15	-0.20**	-0.25**
		(0.16)	(0.11)	(0.09)	(0.12)
import share			-56.61***		
			(7.16)		
Obs	1869	1869	1869	1869	1869
Pseudo R-sq	0.036	0.037	0.038	0.063	0.054

Robust Standard error of Tobit model's estimates in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
(4)includes country dummy
(5)includes industry dummies defined by 16 sections according to HS code

Table 4b: Tariff binding across sectors within countries

	Dependent Variable: Tariff Binding							
	GDP		ω		sector		region	
	High7	Others	Top 33%	Others	Agr.	Manu.	Asia	S.America
	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
$\log(\omega)$	-0.61	-0.85***	0.21	-1.51***	-1.05	-0.52***	-0.71	-0.34*
	(0.45)	(0.19)	(0.56)	(0.39)	(0.88)	(0.09)	(0.44)	(0.20)
$\eta = \varepsilon \frac{m}{y}$	-0.00	-0.01	-0.01*	0.02**	-0.09	0.01	-0.01	-0.02
	(0.02)	(0.00)	(0.00)	(0.01)	(0.34)	(0.01)	(0.00)	(0.01)
political	2.36***	-4.60***	1.14**	1.62**	-2.41	2.45***	-0.58	13.49***
	(0.75)	(0.73)	(0.57)	(0.64)	(1.47)	(0.22)	(0.46)	(1.89)
log(GDP/c)	-7.74***	-15.87***	-6.74***	-9.26***	-18.31***	-5.07***	-10.26***	20.12***
	(0.92)	(1.76)	(0.89)	(1.21)	(2.67)	(0.33)	(1.07)	(3.47)
w.imp.con.	-0.31**	-2.51***	-0.34	-0.48***	-4.10***	-0.27***	-0.55**	1.78**
	(0.13)	(0.86)	(0.24)	(0.17)	(1.18)	(0.10)	(0.23)	(0.84)
Obs	929	940	618	1251	412	1457	858	618
Pseudo R-sq	0.037	0.015	0.032	0.040	0.030	0.096	0.032	0.019

Robust Standard error of Tobit model's estimates in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5a: Tariff binding across sectors by country (High GDP)

	Dependent Variable: Tariff Binding						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	USA#	Japan#	China	Canada#	Brazil	India	Korea#
$\log(\omega)$	-0.15	-0.50***	0.29	-0.24	0.45	-3.27**	2.00
	(0.30)	(0.17)	(0.25)	(0.16)	(0.36)	(1.50)	(2.16)
$\eta = \varepsilon \frac{m}{y}$	0.44***	0.63***	-0.33*	0.00	0.03	-0.16**	-0.44*
	(0.14)	(0.16)	(0.17)	(0.01)	(0.03)	(0.08)	(0.26)
w.imp.con ξ	-0.12	-0.07**	-0.23**	-0.07	-0.07	-1.31***	-0.36
	(0.09)	(0.04)	(0.10)	(0.05)	(0.25)	(0.37)	(0.25)
N	150	152	153	142	60	120	152
pseudo R-sq	0.001	0.028	0.017	0.004	0.010	0.006	0.004

Robust Standard error of Tobit model's estimates in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, and # developed country

Table 5b: Tariff binding across sectors by country (low GDP)

	Dependent Variable: Tariff Binding						
	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Turkey	Thailand	Colombia	Malaysia	Chile	Peru	Uruguay
$\log(\omega)$	-2.00*	-0.46	-1.85***	-0.19	-0.03*	-0.11	-0.06
	(1.02)	(0.31)	(0.56)	(0.43)	(0.01)	(0.08)	(0.28)
$\eta = \varepsilon \frac{m}{y}$	-0.82***	-0.01***	-0.07	0.07	0.00	-0.02***	0.00
	(0.30)	(0.00)	(0.06)	(0.20)	(0.00)	(0.00)	(0.00)
w.imp.con ξ	-5.16**	-0.77*	-1.37	-2.00**	0.00	0.81**	-0.21
	(2.55)	(0.46)	(11.48)	(0.77)	(0.05)	(0.40)	(7.05)
N	101	133	151	148	147	142	118
pseudo R-sq	0.014	0.005	0.008	0.002	0.007	0.018	0.000

Robust Standard error of Tobit model's estimates in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Sector dummy by section

Section	HS2	Description
1	01-05	Animal & Animal Products
2	06-15	Vegetable Products
3	16-24	Foodstuffs
4	25-27	Mineral Products
5	28-38	Chemicals & Allied Industries
6	39-40	Plastics / Rubbers
7	41-43	Raw Hides, Skins, Leather, & Furs
8	44-49	Wood & Wood Products
9	50-63	Textiles
10	64-67	Footwear / Headgear
11	68-71	Stone / Glass
12	72-83	Metals
13	84-85	Machinery / Electrical
14	86-89	Transportation
15	90-97	Miscellaneous
16	98-99	Service