How Do Terms-of-Trade Effects Matter for Trade Agreements?

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Abstract

Negotiated and applied tariffs under the WTO show great variation across sectors and countries. The theoretical literature on trade agreement has generated conflicting predictions about the pattern of negotiated tariffs. Using data on negotiated tariffs under the WTO, we compare the empirical success of existing theories and find empirical evidence that terms-of-trade effects do matter for negotiated tariffs: Sectors with greater import IMP have lower negotiated tariffs. This empirical pattern is consistent with theories that postulate a role for flexibility in trade agreements in a world with political-economy uncertainty.

JEL Classification: F13

1 Introduction

Negotiated and applied tariffs under the GATT and the WTO show a great variation across sectors and countries.[1] In a substantial fraction of sectors worldwide, the negotiated tariffs, which are in the form of *caps* on applied tariff rates, are above the applied rates—a phenomenon known as *tariff overhang* (a.k.a. tariff water). What are the sources of the observed variation in negotiated tariffs? And do governments use their import IMP in choosing tariffs when there is tariff overhang?

Various trade policy models in the literature have generated conflicting theoretical predictions about the pattern of negotiated tariffs. Notably, assuming efficient bargaining, the standard terms-of-trade models (such as Bagwell and Staiger 1999 and Grossman and Helpman 1995) predict that any variation in negotiated tariffs should solely reflect the political-economy preferences of the governments across sectors—i.e., negotiated tariffs must be *independent* of IMP (henceforth IMP). Moreover, tariff overhang does not arise under these models.

Dropping the assumption of efficient bargaining in favor of a bargaining model with free-riding problem, Ludema and Mayda (2013) predict that negotiated tariffs must be *increasing* in the IMP of a country, and that this correlation must diminish significantly with *exporter concentration*. In a sharp contrast, based on a model with export lobbies and transaction costs of negotiations, Nicita, Olarreaga, and Silva (Forthcoming) predict that in sectors with no tariff overhang, negotiated bindings must be negatively correlated with the IMP. Yet in another study that builds on the delegation theory of tariffs (Bagwell and Staiger 2005, Amador and Bagwell 2013), Beshkar, Bond, and Rho (2015) predict that if the future political preferences of the governments are uncertain, optimally-negotiated tariffs must be *decreasing in* (*independent of*) the IMP for low and intermediate (high) levels of the IMP.

Our objective in this paper is to evaluate, both theoretically and empiri-

[1] In Bangladesh, China, Australia, and the U.S., for example, the 10th percentile of tariff rates are 30%, 3%, and 0%, and 0%, while these rates in the 90th percentile are 200%, 18%, 25%, and 9.4%, respectively.

cally, the potential roles that free-riding and uncertainty play in the design of trade agreements. To this end, we propose a model that allows for both free-riding and uncertainty effects. We then test this model using tariff data from the WTO and evaluate the relative importance of these effects on the negotiated and applied tariffs.

Our theoretical findings for the negotiated binding rates are as follows. Tariff bindings are weak, i.e., applied tariffs *may be* below the negotiated bindings under some states of the world, if and only if the IMP is sufficiently low or the free riding problem is sufficiently severe. Moreover, weak (strong) binding rates are decreasing (nondecreasing) in IMP. Finally, as the severity of free-riding problem decreases, the relationship between negotiated tariffs and IMP becomes *more negative.*

Our theory implies a highly non-monotonic relationship between *expected applied tariffs* and IMP. We identify three regions of IMP, namely, low, medium, and high, over which the applied tariffs are increasing, decreasing, and nondecreasing, respectively. To gain an intuition for this result, note that as IMP increases, (i) the unilaterally-optimal tariffs also increase, but (ii) negotiated binding rates become more restrictive, making applied tariffs more likely to be lower than their unilaterally optimal level. In particular, the former effect dominates in the low range of IMP while the latter effect dominates in the intermediate range, leading to a hump-shape relationship between applied tariffs and IMP.[2] Finally, for the high range of IMP, applied and binding rates are always equal and non-decreasing in IMP.

The non-monotonic relationships identified by our theory provide important guidelines for our empirical analysis of tariffs. In particular, for the negotiated tariff bindings, the theory suggests that the effect of IMP is dif-

[2] To further elaborate, note that for low levels of IMP, the binding rates are very high, thus imposing very little restriction on applied tariffs. As a result, in sectors with low IMP, the governments are able to choose their unilaterally optimal tariff in almost all states of the world. This implies a positive association between applied tariffs and IMP within this range, as predicted by the standard optimum tariff theories (i.e., Kahn 1947; Grossman and Helpman 1995). As we move from the low to the intermediate range of IMP, negotiated tariffs are more likely to constrain the government's tariff choices, inducing a downward relationship between applied tariffs and IMP.

ferent for weak and strong tariff binding rates. Consistent with the theory, our empirical analysis shows that when free-riding problem is negligible, binding rates are decreasing in (independent of) IMP for weakly (strongly) bound sectors.[3] At the presence of the free-riding problem, tariff bindings show a positive relationship with the IPM only in the strongly-bound sectors.

In the remainder of the Introduction, we will compare our results with the existing studies of WTO tariffs. Then, after laying out our basic economic environment in Section 2, we introduce our model of tariff negotiations and applied tariffs in Section 3. In Section 5, we present our empirical methodology and findings. Section 6 provides concluding remarks.

1.1 Comparison to the Existing Literature

As in this paper, Beshkar et al. (2015) study the implications of the flexibility-externality tradeoffs in the choice of tariff binding rates. In this paper, we take two further steps. First, we propose a model that incorporates the potential role of free riding in the tradeoff between flexibility and externality. Second, we characterize the government's tariff choice at the presence of tariff overhang and find a hump-shape relationship between the expected applied tariffs and IMP.

Ludema and Mayda (2013), henceforth LM, postulate that the WTO's nondiscrimination clause creates a free-riding problem that discourages relatively small exporters from participating in tariff cut negotiations with an importing country. As a result, since only a subset of exporters participate in the negotiations, only a fraction of the terms of trade externalities of the importing country are internalized. Therefore, the negotiated tariffs should still reflect the terms of trade effects. This free-riding problem is less severe if exporters are concentrated in fewer countries.

[3] Recall that a strongly bound sector is one in which the applied tariff is always equal to the binding rate. In contrast, a sector is weakly-bound if under some states of the world the applied tariff is smaller than the negotiated binding rate.

Consistent with their theory, LM report a monotonically increasing relationship between negotiated tariffs and a measure of IMP. This seems to be at odds with our findings in this paper that negotiated tariffs and IMP show a negative association for low and intermediate values of IMPs and a slightly positive association for high values of IMPs. However, a partial reconciliation between these findings may be obtained by noting that the sample of countries studied by LM consists of only OECD countries for which, generally, negotiated tariffs are low and IMPs are high. LM's sample, therefore, covers a large number of sectors that we categorize as high IMP, but excludes a large number of sectors that we categorize as low and intermediate IMP. As we show both theoretically and empirically, the patterns observed in this subsample cannot be generalized to the entire universe of the WTO tariffs.

A second way in which our empirical study differs from that of LM is the choice of proxies for IMP. As their main measure of IMP, LM use the degree of *product differentiation,* which varies across sectors but not countries. We argue that LM's finding that tariffs are increasing in the degree of product differentiation reveals the role of *Ramsey Taxation*, rather than terms-of-trade effects, in trade agreements. To see this, note that the degree of product differentiation is a direct measure of *demand elasticity* such that products with a lower degree of differentiation have a higher demand elasticity. Moreover, as we know from political-economy models such as Grossman and Helpman (1995), politically optimal tariffs are lower in sectors with more elastic demand. This result reflects a simple Ramsey Taxation argument in political economy trade models: In sectors with a higher demand elasticity, it is more costly for the society to transfer welfare to producers by means of taxing imports. Therefore, politically optimal import tariffs tend to be higher in sectors with a greater degree of product differentiation, which have a lower demand elasticity.

Nicita et al. (ming) propose a model with two main assumptions: (i) Exporting industries receive a higher political economy weight in the government's objective function; (ii) Negotiating tariffs for each sector involves a fixed transaction cost. Under the latter assumption, countries will enter negotiations only in sectors where benefits from liberalization is sufficiently high, namely sectors with high IMP. The tariff bindings in the other sectors are chosen arbitrarily by the importing countries and impose no practical constraint on the applied tariffs. Moreover, due to the former assumption, the optimally negotiated tariffs must be *inversely* related to IMP of the importing country. This result follows because the exporters' profits are more sensitive to tariffs, the greater is the importing country's IMP.

To test the implication of their model, Nicita et al. (ming) regress negotiated tariffs on IMP in the subsample of sectors with no tariff overhang—or "tariff water" in their terminology—in the year of their observations (200X??). They report a negative relationship, which is at odds with the finding of Ludema and Mayda (2013) that negotiated tariffs are increasing in IMP.

Nicita et al. (ming) also investigate the pattern of applied tariffs in sectors with tariff overhang and find a negative association between applied tariffs and IMP in the subsample of sector with a "small" amount of tariff overhang. They interpret this negative association between applied tariffs and IMP as evidence that WTO countries show a *cooperative behavior* even in sectors where tariffs are not strictly bound by the agreement.

Our paper provides an alternative perspective on Nicita et al.'s results. In particular, our model and empirical evidence indicates that the observed pattern of applied tariffs in the weakly-bound sectors is in fact consistent with a *non-cooperative behavior*. To see this, first note that the negotiated tariffs that are set above the applied tariffs—i.e., the weak binding rates–are not chosen arbitrarily as we find a very strong negative correlation between those tariff bindings and IMP. Therefore, while non-cooperative tariffs are increasing in IMP, the constraint imposed by negotiated bindings gets tighter. The latter effect dominates for intermediate values of IMP, leading to a negative association between expected applied tariffs and IMP.

While Nicita et al. find a negative association between tariff binding and IMP for strongly-bound sectors, we find a non-decreasing relationship.

These seemingly conflicting observations may be reconciled by noting the difference between the definition of strong binding in the two papers. Nicita et al. define a sector as having no water in tariffs (i.e., strongly bound in our terminology) if the applied and binding rates are equal in year 200X. We, however, label a sector as strongly bound if no tariff overhang is observed in a sector since the inception of the WTO in 1995. A sector with no tariff water in a particular year is not necessarily a strongly-bound sector since a tariff overhang may arise in other years. In fact, the observed applied tariffs ought to be interpreted as a random variable as they are subject to political economy preference shocks. From the point of view of our model, therefore, the negative relationship between negotiated tariffs and IMP found by Nicita et al. is due their liberal definition of strong binding, which inadvertently includes many sectors with downward flexibility in their subsample.[4]

///To be cited:

Bagwell et al. (2017)

Beshkar and Bond (2017)

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2 The Basic Environment

In this section, we introduce a model of trade agreement under political uncertainty and the free-riding problem caused by the Most-Favored Nation Clause. We first briefly discuss the existing terms of trade models of tariff negotiations that emphasize the role of uncertainty and free-riding problem, respectively. We then offer a hybrid model that incorporates both of these issues.

Trade agreements are often viewed as a solution to the inefficiencies arising from noncooperative policymaking. Trade policy could be used to take advantage of the collective IMP of their domestic consumers vis-a-vis foreign suppliers. To be specific, an import tariff improves a country's terms

[4]"Downward flexibility" is a term used by Bagwell and Staiger (2005) to describe the flexibility under the tariff caps that allows governments to adjust tariffs downward.

of trade by depressing the world price of the imports, while generating a negative externality on the exporting countries. As argued by Bagwell and Staiger (1999), remedying the terms-of-trade externality is the sole benefit of trade agreements within a wide range of neoclassical trade models.

Consider an importing country, henceforth Home, with the following political welfare function in a given sector, k:

$$V(t;\theta) \equiv S(p(t)) + (1+\theta)\Pi(p(t)) + tp^*(t)m(p(t)), \tag{1}$$

and an exporting country with the following welfare function in sector k:

$$V^*(t) \equiv S^*(p^*(t)) + \Pi^*(p^*(t)) \tag{2}$$

where $S(p)$, $\Pi(p)$, and $m(p)$ are the consumer surplus, the producer surplus, and the import demand function, respectively, and and $*$ indicates the corresponding variables for the exporting country. Moreover, the political parameter, θ, is the extra weight that the government assigns to the producer surplus compared to tariff revenues and consumer surplus.

Optimal noncooperative tariff of Home solves $t^N(\theta) = \arg\max_t V(t;\theta)$, which is implicitly given by

$$t^N = \omega + \theta\left(\frac{1+t^N}{\eta}\right),$$

where, $\omega = \left(p^*\frac{m^{*\prime}}{m^*}\right)^{-1}$ is the inverse of the Foreign export supply elasticity, and $\eta = -\frac{pm'}{y}$ is the product of the home import demand elasticity and the import penetration ratio. The noncooperative tariff, therefore, is increasing in the importing country's IMP, ω. Moreover, at the presence of political preferences towards producers, i.e., if $\theta > 0$, the noncooperative tariff is decreasing in the sector's elasticity of demand. The latter relationship is akin to the Ramsey taxation idea: transferring welfare from consumers to producers is more costly the more elastic is the demand for that product. Therefore, optimal tariff is decreasing in demand elasticity.

The jointly efficient tariffs, i.e., the tariff rate that maximizes the joint welfare of the importing and the exporting countries, is the solution to $t^E(\theta) = \arg\max V(t;\theta) + V^*(t)$. Solving this problem yields the efficient tariff

$$t^E(\theta) = \frac{\theta}{\eta - \theta},$$

which is independent of the importing IMP, ω. Therefore, under an efficient trade agreement, any variation in negotiated tariffs should be independent of the variation in IMP and must solely reflect the preferences of the governments for income distribution and the cost of transfers as determined by demand elasticity and import penetration embodied in η.

The theoretical finding that efficiently-negotiated tariffs are independent of countries' IMP hinges on two key assumptions: 1) negotiations are perfectly efficient; and 2) there is no uncertainty about the trade policy preferences of the governments. LM provide a model where negotiations are inefficient (in a sense that will be described below), and predict that negotiated tariffs must be generally *increasing* in IMP, especially in sectors where imports arrive from many different countries. In contrast, using a model with uncertain political-economy preferences, BBR predict that negotiated tariffs must be *decreasing* in IMP. In the remainder of this section, we provide a summary of these papers and offer a hybrid model that incorporates both.

3 Multilateral Tariff Negotiations under Political Uncertainty and the MFN Rule

The flexibility and the free-riding models of negotiated tariffs generate opposing predictions regarding the role of terms of trade effects in tariff negotiations. Nevertheless, these models are not mutually exclusive in the sense that the forces identified in the two models could be at play simultaneously. In this section, we develop a model of multilateral liberalization that takes into account both the desire for flexibility and the role that the MFN rule play in negotiations.

As in Amador and Bagwell (2013) and BBR, we assume that tariff commitments are in the form of caps on the applied tariffs and that the political parameter θ is drawn from a probability distribution, $f(\theta)$. We extend these models to a multi-country setting by making two additional assumptions. First, applied tariffs must satisfy the MFN rule. Second, the negotiated tariff bindings maximize the joint welfare of the importing country and the exporting countries that *participate in negotiations*.

The basic premise of the MFN-induced free-riding model is as follows. Some exporting countries may prefer to stay out of negotiations since the MFN rule allows them to receive the benefit of tariff cuts negotiated by other countries without having to offer any concessions in return. We let P and $\phi(P)$, respectively, denote the set of countries that participate in the negotiations and the fraction of the importing country's imports in this sector that are come from these countries. Due to the free-riding problem $\phi(P) < 1$. Moreover, the more severe the free riding problem is the lower is $\phi(P)$. For brevity, we henceforth use ϕ instead of $\phi(P)$.

As demonstrated by LM, the severity of the free-riding problem depends on the distribution of the export volumes from different countries: the more dispersed is the volume of exports the greater is the free-riding problem since most countries benefit little from negotiations. In contrast, if most of the export is originated from a small number of countries, the importing country will face more aggressive demands for liberalization and, thus, the negotiated tariffs will be lower. Therefore, we follow LM's finding and assume that $\phi(P)$ is decreasing in the degree of exporter concentration.

3.1 Optimal Binding

We assume that the negotiated binding for a given sector of an importing country maximizes the joint welfare of the importing country and the participating exporters, P. Therefore, the optimal tariff binding, denoted by $t^B(P)$, is the solution to the following expected welfare maximization problem:

$$
\begin{aligned}
t^{B}(P) = \arg\max_{t^B} \int_{\underline{\theta}}^{\theta^B} \left[V(t^N(\theta);\theta) + \sum_{j\in P} V_j^* \left(t^N(\theta)\right)\right] f(\theta)d\theta \\
+ \int_{\theta^B}^{\bar{\theta}} \left[V(t^B;\theta) + \sum_{j\in P} V_j^* \left(t^B\right)\right] f(\theta)d\theta,
\end{aligned}
\tag{3}
$$

where V_j^* is the welfare of the exporting country j in this sector, and θ^B is implicitly defined by $t^B \equiv t^N(\theta^B)$.

The first integral in (3) is the expected joint welfare of the participating countries when the unilaterally optimal tariff is lower than the binding, $t^N(\theta) < t^B$. Therefore, in this region, where, $\theta < \theta^B$, the importing country imposes its unilaterally optimal tariff, and there will be a positive tariff overhang. The second integral is the expected joint welfare of the countries for $\theta > \theta^B$, in which case the applied tariff is equal to the binding.

Letting $\sum_{j\in P} V_j^*(t) \equiv \phi V^*(t)$, where $\phi \equiv \phi(P)$ is the share of trade originating from the participating countries, the FOC of the optimization problem 3 will be given by:

$$
\int_{\theta^B}^{\bar{\theta}} \left[V_t\left(t^B,0\right) + \phi V_t^*\left(t^B\right) + \theta \Pi_t\left(t^B\right)\right] f(\theta)\, d\theta = 0,
$$

or

$$
\left[V_t\left(t^B,0\right) + \phi V_t^*\left(t^B\right)\right] + E[\theta|\theta > \theta^B]\Pi_p(p)\frac{dp}{dt} = 0.
$$

Using the properties of the welfare functions, the first-order condition (FOC) for optimality may be written as

$$
(t - (1-\phi)\,\omega)\frac{\eta}{1+t} = E[\theta|\theta > (t-\omega)\frac{\eta}{1+t}], \tag{4}
$$

where, $\eta \equiv \epsilon z$, and $\epsilon \equiv -p\frac{m'(p)}{m}$ is demand elasticity and $z = \frac{m}{s}$ is the import penetration ratio.[5]

[5]For $\phi = 1$, this problem reduces to BBR. For $\phi = 0$, this reduces to the problem of

The left-hand side (LHS) of the FOC (4) is the marginal cost of tariff for the joint welfare of the importing country and the participating exporters, which is increasing in t. Moreover, this expression is increasing in the fraction of the total imports that comes from the participating exporters, ϕ, and decreasing in ω, if $\phi < 1$. The right-hand side (RHS) of the FOC 4 is the marginal benefit of an increase in tariff, which is increasing in (independent of) t if $t > (\leq) \frac{\omega\eta+\underline{\theta}}{\eta-\underline{\theta}}$. The second-order condition for maximization is satisfied if the LHS crosses the RHS from below.

The maximization problem yields a corner solution if LHS crosses RHS at its flat part. Since the corner of the flat part is $t = \frac{\omega\eta+\underline{\theta}}{\eta-\underline{\theta}}$, this requires

$$\left(\frac{\omega\eta+\underline{\theta}}{\eta-\underline{\theta}} - (1-\phi)\,\omega\right)\frac{z\epsilon}{1+\frac{\omega\eta+\underline{\theta}}{\eta-\underline{\theta}}} > E[\theta],$$

or, equivalently,[6]

$$\left(1+\frac{1}{\omega}\right)\frac{1}{\phi} < \frac{\eta-\underline{\theta}}{E[\theta]-\underline{\theta}}.$$

This condition indicates that a corner solution arises if the interaction of IMP and the share of trade by participating exporters is sufficiently large.

At a corner solution, the optimal binding is increasing in IMP, but this increase is slower the higher is ϕ. At an interior solution, an increase in ω shifts down both the LHS and RHS. A downward shift in the RHS tends to reduce the optimal binding, while a downward shift in the LHS tends to increase the optimal binding. The rate of the shift in RHS is slower the larger is ϕ. In particular, when $\phi = 1$, RHS becomes invariant to ω. Therefore,

unilaterally optimal tariff for $\theta = \bar{\theta}$.

[6] Here are the calculations:

$$\frac{\omega\eta+\underline{\theta}}{\eta-\underline{\theta}}\left[\eta - E[\theta]\right] - (1-\phi)\,\omega\eta > E[\theta],$$

$$\omega\eta\left[\eta - E[\theta] - (1-\phi)\,(\eta-\underline{\theta})\right] > (\eta-\underline{\theta})\,E[\theta] - \underline{\theta}\,(\eta - E[\theta])\,.$$

$$\omega > \frac{E[\theta]-\underline{\theta}}{\underline{\theta} - E[\theta] + (\eta-\underline{\theta})\,\phi}.$$

there must exist a threshold value of ϕ above which the net effect of an increase in ω on optimal binding is negative.

Proposition 1. *(i) If* $\left(1+\frac{1}{\omega}\right)\frac{1}{\phi} < \frac{\eta-\overline{\theta}}{E[\theta]-\underline{\theta}}$*, there will be no tariff overhang under the optimal tariff binding, which is given by* $t^B = \frac{E[\theta]+\eta(1-\phi)\omega}{\eta-E[\theta]}$*. Moreover, if* $\phi < 1$*, the optimal tariff binding will be increasing in* ω *and this correlation diminishes as* ϕ *increases.*

(ii) If $\left(1+\frac{1}{\omega}\right)\frac{1}{\phi} > \frac{\eta-\overline{\theta}}{E[\theta]-\underline{\theta}}$*, there exists a local optimum under which tariff overhang is positive for some states of the world,* θ*. Moreover, for a sufficiently large* $\phi < 1$*, the optimal tariff binding is decreasing in* ω *and this correlation strengthens as* ϕ *increases.*

The first part of this Proposition states that when IMP is sufficiently large, the optimal binding is *strong*, i.e., no positive tariff overhang arises under any state of the world. This result, as noted by BBR, reflects the trade-off between flexibility and terms of trade manipulation. Moreover, it states that under strong binding there is a positive correlation between the negotiated binding rates and the importing country's IMP. This result reflects the idea that at the presence of the free-riding problem, the negotiated agreement does not eliminate the importer's terms-of-trade effect on the choice of tariffs.

The second part of this Proposition states that when IMP is relatively low, the relationship between the optimal tariff binding and IMP depends on exporter's participation rate in negotiations, measured by ϕ. In particular, for a sufficiently high rate of participation, optimal tariff binding is *declining* in IMP. For sufficiently low ϕ, this relationship is ambiguous. Nevertheless, for all values of ϕ, the relationship between the optimal binding and IMP will be *more negative* the higher is ϕ.

3.2 Applied Tariffs under the Agreement

As we show in Proposition 1, for sufficiently low IMP—i.e., when $\left(1+\frac{1}{\omega}\right)\frac{1}{\phi} > \frac{\eta-\overline{\theta}}{E[\theta]-\underline{\theta}}$— the negotiated tariff caps are only weakly binding.

That is, for sufficiently low realizations of the political parameter in these sectors, the importing country finds it unilaterally optimal to impose a tariff below the negotiated binding. Therefore, the importing country has the ability–albeit limited— to use its IMP to manipulate its terms of trade.

If tariffs were unbound, the average applied tariffs would be increasing in IMP. But what is the relationship between IMP and the average (i.e., expected) applied tariffs under negotiated tariff bindings? The expected applied tariff may be written as

$$E\left[t^A\right] = \int_{\underline{\theta}}^{\theta^B} t^N(\theta) f(\theta)\, d\theta + \int_{\theta^B}^{\bar{\theta}} t^B(\theta) f(\theta)\, d\theta.$$

Taking derivative of this equation with respect to IMP yields

$$\frac{dE\left[t^A\right]}{d\omega} = \int_{\underline{\theta}}^{\theta^B} \frac{dt^N(\theta)}{d\omega} f(\theta)\, d\theta + \int_{\theta^B}^{\bar{\theta}} \frac{dt^B(\theta)}{d\omega} f(\theta)\, d\theta. \tag{5}$$

The first term on the right-hand side of (5) is positive. Moreover, when ω approaches zero, θ^B will approach $\bar{\theta}$, which implies that the second integral in (5) will approach zero. For sufficiently high ϕ, the second term is negative. It is easy to verify that for $\omega \rightarrow^- \bar{\omega} \equiv \frac{1}{\phi}\frac{E[\theta]-\underline{\theta}}{\eta-\underline{\theta}}$, we have $\frac{dE\left[t^A\right]}{d\omega} < 0$. Finally, for $\omega > \bar{\omega}$ the applied tariff is equal to the negotiated binding as described in part (ii) of Proposition (1). In summary,

Proposition 2. *Under the negotiated tariff bindings, the expected applied tariff will be*

i) increasing in ω if ω is sufficiently low,

ii) decreasing in ω if ω is sufficiently close to but strictly less than $\bar{\omega}$, and ϕ is sufficiently large,

iii) independent of (increasing in) ω if $\omega > \bar{\omega}$ and $\phi = 1$ $(\phi < 1)$. Moreover, the positive relationship in case of $\phi < 1$ weakens monotonically as ϕ increases.

This proposition indicates that under a tariff binding agreement, the applied tariff has a non-monotonic relationship with IMP. In particular, it identifies three regions, namely, low, medium, and high IMP, over which the applied tariff is increasing, decreasing, and weakly increasing, respectively.

4 Data

The main explanatory variable in our analysis is Import Market Power (IMP). One of the empirical challenges in testing theories of tariff choices is to find a measure of IMP. Several measures of IMP have been suggested and used in the literature including the inverse of the foreign export elasticity (IFEE), import volume, share of the world imports, and product differentiation.

Inverse of the Foreign Export Elasticity (IFEE) As our main measure of import market power, we use the inverse of the foreign export elasticity in each sector. We use the estimates of IFEE for six-digit HS sectors provided by Nicita et al.. We instrument for this measure using two sets of instruments that have been previously used by Nicita et al. and Beshkar et al.. The first set of IVs, which we will refer to as IV-1, include the weighted-sum of import demand elasticities in the rest-of-the-world and the world's export supply elasticities. The second set of IVs, to be called IV-2, are constructed as follows. First a dummy is created that equals one when the measure of IMP is in the top two-thirds of all observations for the measure of IMP. Then the average of the dummy is taken within the country, over all products within the same HS2 sector. The resulting average is the instrument. At times the log of the inverse export supply elasticity is also instrumented with some measure of the Rauch PDI.

World Import Share An alternative measure of IMP in a sector is the share of a country in that sector's world trade. We use this measure for robustness check as the existing estimates of IFEE are criticized for lack of precision and accuracy. For example, it appears that the estimates of IFEE provided by Broda et al. (2008) do not accurately capture the variation of IMP across countries: The median IFEE for China is lower than that of Paraguay and Algeria, and in par with that of Bolivia and Ukraine, which is very counter-intuitive given that China is a much larger economy compared to the aforementioned countries. Therefore, IFEE estimates seem to capture more accurately the variation of IMP across sectors within each country. On the contrary, while World Import Share suppresses the information about variation of supply elasticity across sectors, it better captures the variation of IMP across countries in the same sector.

The measurement error associated with the Product Differentiation Index Product differentiation—a binary variable—is used by LM as their main measure of IMP. This choice is based on the argument that, other things equal, the residual supply of the foreign country is more elastic the more elastic is the foreign country's demand for the product. By construction, this measure does not vary across countries and does not capture the effect of import size or the elasticity of foreign supply on IMP. A major problem with using product differentiation as a measure of IMP is that this measure affects the optimal level of tariff directly through a channel that is distinct from IMP.

In models with politically motivated governments (as in Grossman and Helpman 1995), the optimal non-cooperative and cooperative tariffs are both decreasing in demand elasticity. This is essentially a Ramsey taxation argument: the consumption loss associated with an income transfer to the interest groups is higher in sectors with more elastic demand. Since higher product differentiation is associated with lower demand elasticity, the Ramsey taxation argument implies that the optimal tariff should be higher for differentiated products. Therefore, it is not justifiable to attribute the positive association between negotiated tariffs and product differentiation to the effect of terms-of-trade on trade agreements.

Tariff Data We use the tariff data for the year 2007 from WITS. To categorize sectors into strongly and weakly bound sectors, we use the applied tariffs from 1995 to 2007. In particular, a sector is strongly bound if and only if no tariff overhang is observed in any of these years. The tariff data is classified using the HSCombined version and are concorded to match the trade data. In cases where tariff data for 2007 is missing, we use the data from the closest year before 2007. The results do not change when using only the data from 2007.

Exporter Concentration Index As suggested by LM, we use a measure of exporter concentration to proxy for the degree of free-riding problem in tariff cut negotiations for each sector-country pair. In particular, we use a Herfindahl-Hirschman Index for HS6 product k of country i that is calculated as follows:

$$H_{ik} = \frac{\sum_{j \in \mathrm{WTO}_i} M_{ik}^{j2}}{(\sum_{j \in \mathrm{MFN}_i} M_{ik})^2}, \tag{6}$$

where, MFN_i are defined as all countries except for Iran, Cuba, and North Korea, thus $\mathrm{MFN_i}$ is defined in the same manner as Ludema and Mayda (2013). FTA members are defined as any country pair that Baier and Bergstrand give an EIA classification 3-6. A value of 3 corresponds to an FTA, with higher values corresponding to a customs union, a common market, and an economic union. As a robustness check FTA is amended to include PTAs, values of 1 or 2 in the EIA database. Here PTAs are either two-way agreement where tariffs are not fully reduced to zero, or a one-way preferential agreement, such as granting GSP preferences. Trade data is from UN Comtrade at the HS6 level for 1994.

Trade Agreements and Elasticities Data for FTAs and PTAs in force during 1994 are from the NSF-Kellogg Institute Data Base on Economic Integration Agreements, created by Baier and Bergstrand. Inverse export supply elasticities are at the HS6 level from Nicita et al. (2013), whereas LM used Broda and Weinstein (2006) estimates at the HS3 level. The export supply elasticities from Nicita et al. (2013) were estimated from HS6 trade data covering the years 1989-2009, which covers both the Uruguay Round of WTO negotiations, when tariff bindings were negotiated, as well as the cross-sectional year used in this paper, 1994. Import demand elasticities are from Kee et al. (2008), whereas once again LM use HS3 estimates from Broda and Weinstein (2006).

Political Stability We use the World Bank Governance Index, specifically the Political Stability and Absence of Violence measure, to control for country-specific political factors that may affect governments' preference for flexibility. Unlike BBR, we prefer the use of the World Bank Political Stability and Absence of Violence measure as more countries have data available and it dates back farther than The Economist Intelligence Unit used in BBR. The Governance Index is calculated by aggregating data on governments from a variety of sources, such as, consumer and firm survey along with expert opinions. The construction of the index makes use of 35 data sources from 32 organizations. Although there is a margin of error in the calcuated values, many of the cross-country differences are statistically significant. As this paper will be using the Governance Index to control for cross-country variations in political pressures, worries over the percision of the estimations are mitigated. Since the World Bank does not report this value for the European Union, we construct this measure for the EU by taking a GDP-weighted average the political stability measure for EU members.

Summary Statistics Table 2 provides summary statistics for the full sample of countries using trade data from 1994, for a list of countries see the Appendix. One of the differences between BBR and LM is the list of countries used. LM use a smaller set of countries. LM also combines ome countries into customs unions, but outside of the European Union, the paper is not explicit on which customs unions are used, and their members. Due to this ambiguity, only the European Union is treated as one member when looking at their subset of countries. Table 1 provides the same summary statistics, but for the countries used in LM for which we have data. However the tables are similar and the tables are also similar to Table 2 in BBR. As is to be expected, the sample of LM countries exhibit lower tariff bindings, few products with tariff overhang, and lower average tariff overhang. The reason these results are to be expected, is that the sample in LM consists of more developed countries, which have lower bound tariffs, are more likely to not have tariff overhang, and when they do have tariff overhang, have a lower level of overhang.

5 Empirical Evidence

Based on our model, we now empirically evaluate how the flexibility-externality tradeoff and the free-riding problem shape the structure of the negotiated and applied tariffs in the WTO.

Evidence on Negotiated Tariffs

Our key empirical finding is that the flexibility-externality tradeoff could explain a substantial part of the variation in negotiated tariffs, while the free-riding problem appears to have a second-order effect. In particular, we find that the predicted positive effect of free-riding problem on the negotiated tariff levels manifests itself in the data *only if* we isolate the much-larger and negative effects caused by the flexibility-externality tradeoff.

Our main estimating equation is as follows:

$$\begin{aligned} t^B_{ik} = \alpha + \beta_1 MP_{ik} + \beta_2 (MP * H)_{ik} + \beta_3 PS_i \\ + \beta_4 (FTAShare/\mu)_{ik} + \beta_5 H_{ik} + \delta_{HS2} + \epsilon_{ik}, \end{aligned} \tag{7}$$

In this equation, i is the importing country, k is the HS6 product, t^B_{ik} is the tariff binding, MP_{ik} is a measure of IMP, H_{ik} is the HHI measure described in Equation 6, PS is the country-specific political stability index, $(FTAShare/\mu)_{ik}$ is the share of imports from FTA partners divided by the import demand elasticity, and δ_{HS2} represents the set of sector dummies.

Recall from proposition 1 that the flexibility-externality tradeoff and the free-riding problem create opposing forces in the relationship between negotiated tariffs and IMP. These opposing forces give rise to a non-monotonic relationship between negotiated tariffs and IMP, namely, β_1 must have opposite signs for the subsample of weak and strong tariff bindings. Two different strategies may be employed to capture this predicted non-monotonicity, namely:

i. *Running separate regressions on the weak and strong binding subsamples.*

ii. *Interacting the IMP measure with a dummy variable that indicates whether the tariff binding is weak or strong.*

Table 5 reports the results of our regressions on the weak and strong binding subsamples as well as the entire sample. Consistent with part 1 of Proposition 5, the coefficient of IMP is negative if Equation (6) is estimated on the weak binding subsample (Column 1). This coefficient will be still negative–albeit smaller—if we use the entire sample that includes both weak and strong binding sectors.

After isolating the effect of the flexibility-externality tradeoff on negotiated tariffs, we also find a secondary (i.e., smaller) role for the free-riding problem. First, the coefficient of IMP is positive for the strong binding subsample. The fact that the coefficient of IMP is positive only for the strong binding subsample—in which the binding agreement *does not* provide any unilateral flexibility—indicates that the positive effect of the free-riding problem on negotiated tariff levels manifests itself *only if* the large and negative effect of the flexibility-externality tradeoff on negotiated tariffs is isolated. Moreover, under all specifications, the coefficient of the interaction term IMP*HHI is negative. This observation provides further evidence that the free-riding problem has influenced negotiated tariffs: the negotiated tariffs tend to decrease as exporters become more concentrated in fewer exporting countries thereby reducing the extent of the free-riding problem.

The last two columns of Table 5 are most closely related to Ludema and Mayda (2013) in which Equation 7 is estimated without splitting the sample into weak and strong binding sectors—i.e., assuming a *monotonic* relationship between negotiated tariffs and IMP. These regressions yield a *negative* coefficient for IMP whether we include all WTO members or only the OECD countries as in Ludema and Mayda (2013). The stark difference between our results are mostly due to the difference between our measures of IMP and negotiated tariffs. For example, as in their paper, we find a positive correlation between negotiated tariffs and the product differentiation index. However, as we argue in Section (4), the use of the product differentiation index as a measure of IMP, or applied tariffs as a measure of negotiated tariffs, involves significant measurement errors and causes a bias in estimations.

To check the robustness of the results in Table 5, we use an alternative measure of IMP (i.e., World Import Share), an alternative definitions of HHI (excluding internal PTA trade), and a different subsample of countries (OECD members, as in LM). All the results remain qualitatively the same[7]. We also include the Product Differentiation Index (PDI), which is used by LM to proxy IMP, as an explanatory variable. Similar to LM, we find a strong and positive relationship between negotiated tariffs and PDI. However, we argue that PDI is primarily a measure of demand elasticity, which is expected to be positively related to import tariffs due to the Ramsey Taxation argument, rather than the optimum tariff argument.

Our second strategy to capture the predicted non-monotonicity in the relationship between $t^B$and IMP is to interact IMP with strong binding (SB) and weak binding (WB) dummies, which modifies Equation 7 as follows:[8]

$$\begin{aligned} t_{ik}^{B} = \alpha + \beta_1(MP * SB)_{ik} + \beta_2(MP * WB)_{ik} + \beta_3(MP * H)_{ik} + \\ \beta_4 PS_i + \beta_5(FTAShare/\mu)_{ik} + \beta_6 H_{ik} + \delta_{HS2} + \epsilon_{ik}, \end{aligned} \tag{8}$$

The IV estimates of this equation, presented in Table 6, are consistent with

[7]available upon request

[8]Note that the construction of these variables implies that $SB + WB = 1$.

the implication of Proposition 1 that $\beta_1 \geq 0$, $\beta_2 < 0$, and $\beta_3 < 0$. These estimates are robust to how trade agreement members are defined. Although the IMP and exporter concentration interaction term is smaller and less signification when PTA members are also excluded from the calculation of HHI. Lastly, the results are robust to including PDI as an explanatory variable.

The results presented in Table 6 offer further evidence that both the flexibility-externality tradeoff and the free-riding concerns have played a role in the WTO tariff cut negotiations. Importantly, in all the estimations, $\beta_1 + \beta_2$ is negative and statistically significant, which indicates that in shaping the relationship between tariffs and IMP, the flexibility-externality tradeoff is a stronger force than free-riding.

6 Conclusion

This paper aims to address a puzzle in the literature concerning how terms of trade effect matter for tariff negotiations. As articulated by (Bagwell and Staiger, 1999), the first-best trade agreements eliminate the terms-of-trade effects. Various empirical studies, including Ludema and Mayda (2013), Beshkar et al. (2015); Beshkar and Bond (2017), and Nicita et al. (ming), show that the real world trade agreements deviate from the first best. However, these papers generate conflicting views about why the first best is not achieved in negotiations and how terms-of-trade effects continue to govern the trade agreements.

In this paper we design and test a model that takes into account the uncertainty about future political economy preferences and the MFN-induced free-riding problem in tariff negotiations. We predict that if there is significant uncertainty about future political economy preferences, the governments tend to negotiate lower tariffs in sectors with larger terms-of-trade effects. Conversely, if the free-riding problem is a major factor in trade negotiations, tariffs tend to be larger in sectors with a greater terms of trade effect.

Testing this model using the WTO negotiated tariffs, we find overwhelming support for the view that uncertainty about future political economy preferences shape the WTO agreement on tariffs. In particular, we find that negotiated tariffs are inversely related to the degree of the terms of trade effects in a sector. This relationship reflects an important tradeoff that the negotiators face: A more stringent tariff binding reduces the negative terms-of-trade externality but at the same time it also reduces the governments' ability to respond to uncertain political economy shocks. Therefore, the weaker are the terms of trade effects, the greater is the value of providing flexibility to the governments through higher negotiated tariffs.

We also find that the free-riding problem might have a second-order effect on negotiated tariffs. We find that tariffs have been negotiated *harder* in sectors with more concentrated exporters. In particular, the observed negative correlation between negotiated tariffs and import market power is stronger the more concentrated are the exporters in fewer countries.

Appendix

Table 1: *Sample: LM Countries*

	All Items	Bound Sectors	Bound and Inverse Exp Elas	Bound & Rauch	Bound, Exp Elas & Rauch	Bound, Exp Elas, Rauch, & HHI	Bound, Exp Elas, Rauch, HHI, Imp Demand Elas
Total Products	130,034	105,658	83,667	85,838	67,793	66,583	52,936
Average Binding	26.15	26.15	23.45	26.16	23.42	23.58	23.86
Number Products w/ Overhang	79,461	49,421	61,421	61,087	48,445	48,474	39,596
Percent w/ Overhang	61.11	46.77	73.41	71.17	71.46	72.80	74.80
Average Overhang	16.94	16.94	14.77	16.90	14.75	14.84	15.37
Number Differentiated Products	72,008	59,175	47,557	59,175	47,557	47,108	37,623
Percent Differentiated Products	55.38	56.01	56.84	68.94	70.15	70.75	71.07
Average Inverse Exp Elas	-2.30	-2.20	-2.20	-2.19	-2.19	-2.18	-2.16
Number of Countries	33	32	32	32	32	32	32

Table 2: *Full Sample*

	All Items	Bound Sectors	Bound and Inverse Exp Elas	Bound & Rauch	Bound, Exp Elas & Rauch	Bound, Exp Elas, Rauch, & HHI	Bound, Exp Elas, Rauch, HHI, Imp Demand Elas
Total Products	232,090	149,287	113,755	121,030	91,948	90,464	73,601
Average Binding	27.85	27.85	24.95	27.91	24.98	25.13	25.38
Number Products w/ Overhang	116,198	116,147	85,644	94,267	69,271	68,271	56,699
Percent w/ Overhang	50.07	77.80	75.29	77.89	75.34	75.47	77.04
Average Overhang	18.98	18.98	16.67	18.96	16.68	16.77	17.37
Number Differentiated Products	130,157	83,249	64,609	83,249	64,609	64,057	52,361
Percent Differentiated Products	56.08	55.76	56.80	68.78	70.27	70.81	71.14
Average Inverse Exp Elas	-2.58	-2.45	-2.45	-2.46	-2.46	-2.45	-2.45
Number of Countries	63	54	54	54	54	54	54

Table 3: *LM Sample of Countries: Simple Specification*

	log (inverse export elasticity)				Rauch PDI
	IV-Tobit PDI inclded		IV-Tobit		Tobit
	FTA	PTA	FTA	PTA	FTA
MP	-2.235***	-1.604***	-2.378***	-1.823***	2.074*
	(0.458)	(0.532)	(0.522)	(0.599)	(1.182)
MP*HHI	-4.298***	-5.021***	-4.482***	-5.074***	-0.268
	(0.679)	(0.728)	(0.721)	(0.827)	(1.752)
Political Stability	-9.904***	-9.724***	-9.922***	-9.715***	-12.40***
	(0.505)	(0.551)	(0.545)	(0.583)	(0.463)
FTAShareMu	0.215**	0.186**	0.0856	0.0765*	0.512***
	(0.0996)	(0.0770)	(0.0580)	(0.0432)	(0.139)
HHI	-6.576***	-11.79***	-6.983***	-12.03***	10.82***
	(2.053)	(2.133)	(2.237)	(2.108)	(1.316)
Constant	19.08***	22.12***	18.68***	21.62***	20.84***
	(1.837)	(2.228)	(2.641)	(2.904)	(2.020)
Observations	52,871	52,202	65,023	64,167	59,759

[1] Clustered standard errors by Country-HS2 in parentheses
[2] *** p<0.01, ** p<0.05, * p<0.1
[3] HS2 dummies included in all estimations

Table 4: *Full Sample of Countries, Simple Specification*

	log (inverse export elasticity)				Rauch PDI	log(inverse)	
	IV-Tobit PDI included		IV-Tobit		Tobit	IV-Tobit	
	FTA	PTA	FTA	PTA	FTA	FTA	PTA
MP	-3.811***	-3.770***	-4.116***	-4.223***		-3.810***	-3.787***
	(0.499)	(0.767)	(0.542)	(0.709)		(0.501)	(0.829)
MP*HHI	-4.792***	-4.352***	-4.786***	-4.119***	-2.164	-4.803***	-4.350***
	(0.953)	(0.959)	(0.848)	(0.681)	(1.545)	(0.956)	(0.923)
Political Stability	-7.830***	-7.697***	-7.908***	-7.765***	-10.88***	-7.830***	-7.702***
	(0.464)	(0.532)	(0.618)	(0.515)	(0.481)	(0.465)	(0.609)
FTAShareMu	0.230**	0.202	0.0664	0.0621	0.694***	0.229**	0.0182
	(0.0901)	(0.141)	(0.0647)	(0.0501)	(0.180)	(0.0902)	(0.0463)
HHI	-10.40***	-11.32***	-10.31***	-10.70***	11.46***	-10.39***	-11.30***
	(2.666)	(2.973)	(2.752)	(2.106)	(1.182)	(2.678)	(2.853)
Rauch PDI					3.501***	2.664***	2.434***
					(1.050)	(0.588)	(0.558)
Constant	16.19***	17.18***	15.31***	15.95***	21.39***	13.51***	14.66***
	(2.920)	(2.682)	(2.637)	(3.425)	(2.134)	(2.972)	(3.743)
Observations	73,479	72,065	90,677	88,890	85,001	73,479	72,065

[1] Clustered standard errors by Country-HS2 in parentheses
[2] *** p<0.01, ** p<0.05, * p<0.1
[3] HS2 dummies included in all estimations

Table 5: *Subsample: Strong Binding*

	All Countries		LM Countries	
	FTA	PTA	FTA	PTA
MP	2.744***	1.832***	2.464***	1.932***
	(0.431)	(0.473)	(0.437)	(0.484)
MP*HHI	-4.480***	-2.565***	-3.853***	-2.707***
	(0.788)	(0.722)	(0.608)	(0.618)
Political Stability	-10.84***	-10.99***	-14.39***	-14.67***
	(1.008)	(0.959)	(1.435)	(1.326)
FTAShareMu	0.0212	0.0145	0.0522	0.0404
	(0.0836)	(0.0756)	(0.107)	(0.133)
HHI	-3.584**	0.511	-0.691	0.614
	(1.544)	(1.502)	(1.481)	(1.173)
Constant	11.92**	10.75***	17.33***	17.41***
	(5.612)	(3.801)	(3.807)	(3.880)
Observations	20,726	20,322	16,330	16,089

[1] Clustered standard errors by Country-HS2 in parentheses
[2] *** p<0.01, ** p<0.05, * p<0.1
[3] HS2 dummies included in all estimations

Table 6: *Hybrid Model: Estimating Equation 8*

	FTA	PTA	FTA
MP*SB	6.824***	5.816***	6.767***
	(0.960)	(1.239)	(1.518)
MP*WB	-8.348***	-9.267***	-8.301***
	(0.711)	(0.916)	(0.880)
MP*HHI	-3.549***	-1.722**	-3.239***
	(0.889)	(0.823)	(0.913)
Political Stability	-5.858***	-5.826***	-5.814***
	(0.497)	(0.451)	(0.624)
FTAShareMu	0.0673	0.0663*	0.191*
	(0.0424)	(0.0398)	(0.114)
HHI	-4.827*	-2.160	-3.766
	(2.675)	(2.763)	(2.472)
Rauch PDI			2.786***
			(0.688)
Constant	1.241	-0.375	-1.452
	(3.264)	(3.765)	(4.148)
Observations	90,677	88,890	73,479

[1] Clustered standard errors by Country-HS2 in parentheses
[2] *** p<0.01, ** p<0.05, * p<0.1
[3] HS2 dummies included in all estimations

References

Amador, A. and K. Bagwell (2013). The Theory of Optimal Delegation With an Application to Tariff Caps. *Econometrica 81*(4), 1541–1599.

Bagwell, K. and R. Staiger (2005). Enforcement, Political Pressure, and the General Agreement on Tariffs/World Trade Organization Escape Clause. *The Journal of Legal Studies 34*(2), 471–513.

Bagwell, K. and R. W. Staiger (1999). An economic theory of GATT. *American Economic Review 89*(1), 215–248.

Bagwell, K., R. W. Staiger, and A. Yurukoglu (2017). Nash-in-Nash TariFF Bargaining with and without MFN. *Working Paper*.

Beshkar, M. and E. Bond (2017). Cap and Escape in Trade Agreements. *American Economic Journal-Microeconomics*.

Beshkar, M., E. Bond, and Y. Rho (2015). Tariff Binding and Overhang: Theory and Evidence. *Journal of International Economics 97*(1), 1–13.

Broda, C., N. Limão, and D. Weinstein (2008). Optimal tariffs and market power: the evidence. *American Economic Review 98*(5), 2032–2065.

Broda, C. and D. E. Weinstein (2006). Globalization and the Gains from Variety. *The Quarterly Journal of Economics 121*(May), 541–585.

Grossman, G. and E. Helpman (1995). Trade Wars and Trade Talks. *Journal of Political Economy 103*(4), 675.

Kahn, R. F. (1947). Tariffs and the terms of trade. *The Review of Economic Studies 15*(1), 14–19.

Kee, H. L., A. Nicita, and M. Olarreaga (2008). Import Demand Elasticities and Trade Distortions. *Review of Economics and Statistics 90*(4), 666–682.

Ludema, R. D. and A. M. Mayda (2013). Do terms of trade effects matter for trade agreements? Theory and evidence from wto countries. *Quarterly Journal of Economics 128*, 1837–1893.

Nicita, A., M. Olarreaga, and P. Silva (2013). Cooperation in WTO ' s Tariff Waters Alessandro Nicita Marcelo Olarreaga. (June).

Nicita, A., M. Olarreaga, and P. Silva (Forthcoming). Cooperation in WTO's Tariff Waters. *Journal of Political Economy*.