Tariff Overhang and Aid: Theory and Empirics

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Abstract

In this paper, we consider aid payments as a possible explanation for tariff overhangs. We set up a theoretical model in which rich countries use development aid to pay for tariff concessions. Developing countries, in turn, may anticipate such a policy in the negotiations for tariff bindings. Setting the bound tariff rate at a relatively high level can serve as a mechanism to incentivize rich countries to carry on with aid payments in the subsequent "aid for trade" game. We empirically examine this hypothesis using detailed data on WTO members' bound and applied tariff rates under the Uruguay agreement. The data sample contains almost all aid recipients participating in the Uruguay round negotiations. Our results provide strong support for the model's prediction that larger tariff overhangs are implemented by countries that receive more aid.

Keywords: Foreign aid, tariff binding, tariff overhang

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1 Introduction

Most world trade takes place under WTO (and former GATT) regulation: 75 percent of all countries are members of the organization and a further 11 percent are under observation to acquire membership. Almost all tariffs are thereby subject to regulation set in multilateral trade negotiations. The high participation in multilateral agreements reflects the success of the multilateral trade negotiation system in liberalizing world trade. Thus, it may be surprising that many countries, especially in the developing world, have committed to tariff ceilings, so-called "tariff bounds", which exceed applied rates on most products so that much of world trade takes place under nonbinding tariff constraints (see, e.g., WTO, 2009).

This observation of a positive "tariff overhang" is difficult to reconcile with standard theoretical hypotheses on incentives for governments in trade negotiations. If special interest pressure determines protection, tariff outcomes of trade negotiations reflect the stakes of domestic and foreign industries (Grossman and Helpman, 1995). If tariffs arise from a motivation of manipulating the terms-of-trade to reap unilateral trade gains, trade negotiations can result in an internalization of these terms-of-trade externalities (Bagwell and Staiger 1999). In both cases, there seems to be no reason to negotiate bound tariffs that exceed applied tariff rates in noncooperative equilibrium.

The negotiation of tariff ceilings instead of actual tariff rates can be explained, however, if additional factors are taken into account. If interest group pressure influences domestic tariff policies and if capital is inter-sectorally mobile, governments can opt for tariff bindings to counteract investment distortions (Maggi and Rodríguez-Clare 2007). Other reasons for negotiating tariff ceilings are contracting costs under uncertainty (Horn et al., 2010) or a trade-off between commitment in negotiations with trade partners and flexibility to respond to future changes in political pressure by special interests under the agreement (Bagwell and Staiger, 2005). The tariff overhang is lower under higher importer market power because of stronger enforcement to reduce the tariff bound in negotiations and a starker terms-of-trade improvement of applied tariff protection (Beshkar et al., 2015).

In this paper, we examine an explanation for tariff bounds that hinges on the fact that developing countries are overrepresented in the use of tariff overhangs and regularly adopt larger tariff overhangs than other countries. According to our hypothesis, development aid may serve as an instrument to influence tariffs of developing countries. Rich countries may buy access to poorer countries' markets by promising aid payments in return for tariff concessions. Developing countries, in turn, anticipate such a policy when negotiating the multilateral trade agreement. Setting the bound rate at a high level then serves as a mechanism to incentivize rich countries to carry on with aid payments in the subsequent "aid for trade" game. We empirically examine this hypothesis using detailed data on WTO members' bound and applied tariff rates under the Uruguay agreement. Our country sample includes 95 percent of the aid recipients that were WTO members at the time. The results provide strong support for the predictions that countries with higher aid receipts adopt larger tariff overhangs because they negotiate higher tariff bounds and use lower applied tariffs.

The rest of this paper is structured as follows: In the next section, a description of related studies is provided to place our contribution in perspective. A theoretical model that illustrates main mechanisms at work is presented in section 3. A detailed overview of the tariff data is given in section 4 and the empirical investigations are presented in section 5. The last section concludes.

2 Background

Market power is a central feature of multilateral trade negotiations. A classic argument for tariff protection is that the government of a country with market power can restrict imports to improve its terms-of-trade. As this argument also holds for the foreign trading partners as well, countries are likely to set tariffs at inefficiently high levels, incurring losses in noncooperative equilibrium. Governments acting under social welfare motives may therefore forge international trade agreements to enforce mutual tariff reductions. Two pillars of the multilateral trade negotiation system counteract terms-of-trade manipulation: the nondiscrimination principle and the reciprocity principle (Bagwell and Staiger, 1999). Empirical evidence shows that elasticities of foreign export supply affect tariff rates that are not subject to WTO regulation (Broda et al., 2008) so that larger tariff cuts are incurred upon WTO membership if importer market power is stronger (Bagwell and Staiger, 2011). However, protectionism to raise the terms-of-trade may not be completely eliminated by the multilateral trade negotiation system due to various reasons: exceptions from nondiscrimination in its regulatory framework (Bagwell and Staiger, 1999), free riding of exporters with low stakes on the most-favored-nation tariff (Ludema and Mayda, 2013),[1] and nonbinding MFN tariffs (Beshkar et al., 2015; Nicita et al., 2018).

That industry-specific interests may influence tariff outcomes is well established in the political-economy literature.[2] Governments may take into account interests of the

[1]Recent evidence by Ludema et al. (2019) indicates that the latter effect has been counteracted by the formation of preferential trade agreements, pointing to a building-block effect of preferential trade liberalization.

[2]See, e.g., Hillman (1982) or Grossman and Helpman (1994). For an application of the Grossman-

import competing industry in addition to implications for the aggregate welfare of their constituency. The resulting tariff rate is higher at a less elastic import demand due to limited deadweight loss, and it is higher at a larger ratio of domestic output to imports because of larger gains at stake of industry-specific interests and lower welfare costs (Grossman and Helpman, 1994).[3] In large countries, the tariff rate is also higher at a less elastic foreign export supply due to the additional incentive to manipulate terms-of-trade (Grossman and Helpman, 1995). While the terms-of-trade effect can be neutralized by effective negotiation, the uneven political influence of interest groups is certain to filter into the agreement. A higher negotiated tariff rate results if industry interests in the importing country exert stronger political power over their government compared to corresponding interests in the exporting country.

Governments can opt for negotiating tariff ceilings (weak bindings) instead of actual tariff rates (strong bindings) to ensure that they have the discretion to respond should shocks appear that affect policymaking constraints.[4] Weak bindings enable governments to levy lower tariffs and to incur higher national welfare in the absence of such events. Contracting costs can be important in explaining the negotiation focus on weak tariff bindings under uncertainty about future conditions (Horn et al., 2010). Bagwell and Staiger (2005) and Amador and Bagwell (2013) model the trade-off between allowing governments to react to the political influence of special interests and restricting the ability to manipulate the terms-of-trade. They show how a tariff ceiling may arise endogenously from this trade-off. A tariff ceiling also preserves the political influence of industry interests and reduces the net returns from influencing the negotiation, which counteracts inefficiencies arising from a distorted allocation of capital (Maggi and Rodríguez-Clare, 2007).

Tariff overhang reflects flexibility in policymaking, which is utilized because the future political influence of import-competing producers is uncertain (Bagwell and Staiger, 2005). Policymakers face political uncertainty as the demand from the import-competing sector varies over time (due to changing production conditions within and between industries in this sector). Governments in countries where this variability is larger are thereby expected to implement larger tariff overhangs. The tariff overhang decreases with importer market power as the terms-of-trade externality of protection stimulates negotiation partners to exert more effort to reduce the bound rate and leads to a higher applied tariff rate under the agreement (Beshkar et al., 2015). Additionally, the gains

Helpman model to a developing country context, see Mitra et al. (2002).

[3]More recently, the empirical relevance of this hypothesis has been placed under scrutiny by Imai et al. (2009; 2013), who show that testing the model using quantile regressions overturns its support and uncovers a positive link between protection and import penetration.

[4]In a related setting, Busch and Pelc (2014) compare the use of tariff bindings to that of trade remedies in the WTO.

from negotiating binding tariff reductions compared to contracting costs are increasing in importer market power (Nicita et al., 2018).

The relationship between foreign aid and tariffs of recipient countries has been analyzed before. To our knowledge, however, none of the existing literature deals with its implications for tariff bindings. In Lahiri and Raimondos-Møller (1997), aid increases demand for goods exported by the donor. Due to this effect, the donor country allocates more aid to a recipient country that has a low tariff rate. Lahiri et al. (2002) extend this analysis allowing the donor country to commit to aid payments that are contingent on subsequently set tariff rates by the recipients. Nanivazo and Lahiri (2015) analyze the implications of conditional aid that is given as a prize depending on the tariff policy of recipient countries.

3 The model

Our model characterizes in stylized form international trade agreements between developed and developing countries, incorporating voluntary foreign aid payments. We consider two countries, one in the North N and one in the South S. The country in N exports a final good q to the country in S on which the government in S may set an import tariff with tariff rate $\tau \geq 0$. The political objectives of the government in N and of its trading partner in S with regard to the tariff are given in reduced form by $V^N(\tau)$ and $V^S(\tau)$. These objective functions can be interpreted as representing aggregate welfare but may also incorporate political economy elements as outlined in the preceding discussion of the literature. Both objective functions are twice differentiable. We furthermore assume that V_N monotonically declines in the tariff rate τ, i.e., $V^N_\tau(\tau) < 0$, whereas V_S first increases and then declines in τ such that there exists a strictly positive optimum tariff rate from the view of the importing country. Let this optimum tariff be denoted by $\hat{\tau} > 0$, i.e., $V^S_\tau(\hat{\tau}) = 0$. Due to the negative spillover of the tariff to the exporting country, the tariff rate that maximizes the joint payoff of both countries would be accordingly lower than $\hat{\tau}$. With τ^* denoting this jointly optimal tariff rate, we have $\tau^* < \hat{\tau}$.

For the role of development aid, we consider a setting in which aid is not merely a lump-sum transfer from rich to poor countries but has positive allocative effects in the South. More precisely, we assume a development project that requires aid payments of a from country N and yields a benefit of $b = \beta a$ to country S, with $\beta > 1$. With aid, the per period payoff for the North is $W^N = V^N(\tau) - a$ and that for the South is $W^S = V^S(\tau) + \beta a$.

In a static non-cooperative setting without international agreements, country S would set the tariff at the optimum rate $\hat{\tau}$, whereas country N would pay no development aid.

By negotiating a trade agreement alone, both countries could reduce the tariff to the joint optimum rate τ^*, but there still would be no tariff overhang or aid payment. The outcome may change if the aid and tariff game is repeated. With an infinite time-horizon, a cooperative solution can be supported by a subgame perfect equilibrium (see, e.g., Dixit 1987, or Bagwell and Staiger, 1990). In our model, tariff concessions by the South can be incentivized by aid payments from the North and vice versa.[5] To characterize such self-enforcing agreements, we consider the following setting: In an initial period $t = 0$, both countries negotiate a weak tariff binding $\tau^b < \hat{\tau}$ and from period $t = 1$ on, country S can set the cooperative tariff rate τ^c or the tariff bound τ^b while country N decides whether to pay aid a or not. We consider trigger strategies in which country S sets the tariff at the cooperative level $\tau_t = \tau^c$ and country N pays aid $a_t = a$, but each country reverts to noncooperative policies $\tau_t = \tau^b$ and $a_t = 0$ for the remainder of the game if the respective other country has deviated from its cooperative policy.[6]

Given these trigger strategies, we can determine the necessary conditions for enforcement of the cooperative outcome. With δ as discount factor ($0 < \delta < 1$), country S does not deviate from the trigger strategy as long as $V^S(\tau^b) + \beta a + \sum_{t=2}^{\infty} \delta^{t-1} V^S(\tau^b) \leq \sum_{t=1}^{\infty} \delta^{t-1}[V^S(\tau^c) + \beta a]$. Rearranging yields

$$\text{Constraint S:} \qquad V^S(\tau^b) - V^S(\tau^c) \leq \delta\beta a \; . \tag{1}$$

Similarly, country N does not deviate if $V^N(\tau^c) + \sum_{t=2}^{\infty} \delta^{t-1} V^N(\tau^b) \leq \sum_{t=1}^{\infty} \delta^{t-1}[V^N(\tau^c) - a]$, or

$$\text{Constraint N:} \qquad \delta[V^N(\tau^c) - V^N(\tau^b)] \geq a \; . \tag{2}$$

Both constraints would be satisfied as equalities for $a = 0$ and $\tau^b = \tau^c$. If there were no aid payments, the tariff binding could be lowered to the cooperative tariff rate. Tariff concessions can already be part of the negotiated tariffs such that there would be no need for a tariff overhang for their enforcement. North and South would then set tariffs directly at the joint optimal rates, and there would be no tariff overhang. The situation is different for aid payments that are not part of the multilateral agreement. With a strictly positive aid level, constraint N requires a tariff overhang ($\tau^c < \tau^b$) to ensure incentive compatibility for country N. Similarly, according to constraint S, incentive compatibility

[5] Another possible argument for linking trade agreements with foreign aid is analyzed by Maoz et al. (2011), who consider an endogenous growth model in which aid improves the international allocation of capital.

[6] For certain parameter constellations, a self-enforcing agreement may also exist without a tariff binding. In such a setting, the non-cooperative tariff in the trigger strategy would be given by $\tau_t = \hat{\tau}$. As will become clear below, a tariff binding below $\hat{\tau}$ may improve upon this possible outcome.

for country S requires aid payments if there is a tariff overhang.

Define $\tau^{\text{Sc}} \equiv \tau^{\text{Sc}}(\tau^b)$ as the critical tariff binding at which constraint (1) for the South is satisfied as an equality. As the l.h.s. of (1) is decreasing in τ^c for a given bound rate τ^b, τ^{Sc} determines a lower limit for τ^c. It specifies the minimum cooperative tariff that can be set without inducing country S to choose the bound tariff rate instead. Similarly, we can define a critical tariff binding for the North $\tau^{\text{Nc}} \equiv \tau^{\text{Nc}}(\tau^b)$, which determines an upper limit, i.e., the maximum cooperative tariff that is incentive compatible for country N. At a higher cooperative tariff rate, country N would choose to pay no aid given that country S plays the trigger strategy. Since τ^{Sc} determines a lower limit and τ^{Nc} specifies an upper limit for the cooperative rate, the two incentive compatibility constraints can only be satisfied jointly for $\tau^{\text{Sc}} \leq \tau^{\text{Nc}}$. Both critical values of τ^c are increasing in the cooperative tariff rate τ^b:

$$\frac{d\tau^{Nc}}{d\tau^b} = \frac{V_\tau^N(\tau^b)}{V_\tau^N(\tau^{Nc})} > 0 \quad \text{and} \quad \frac{d\tau^{Sc}}{d\tau^b} = \frac{V_\tau^S(\tau^b)}{V_\tau^S(\tau^{Sc})} > 0 \,. \tag{3}$$

Figure 1 illustrates a scenario in which both constraints are satisfied and shows how the critical values of τ^c depend on the bound rate.[7] For $\tau^c < \tau^*$, governments have an incentive to jointly raise the cooperative rate. Thus, τ^c is chosen as high as possible such that (2) becomes binding and $\tau^c = \tau^{\text{Nc}}$ (red segment of the τ^{Nc} line). For $\tau^c > \tau^*$, governments set τ^c as low as possible such that constraint (1) binds and $\tau^c = \tau^{\text{Sc}}$ (red segment of the τ^{Sc} line).

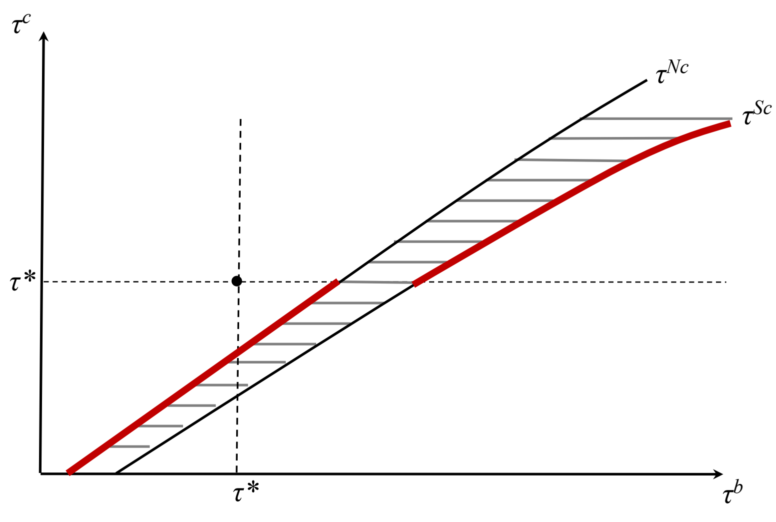

Figure 1: Incentive Constraints

[7]In figure 1, $\tau^{\text{Nc}} > \tau^{\text{Sc}}$ is assumed for all relevant values of τ^b. Another possible outcome would be that both lines intersect such that both constraints are satisfied only for a certain range of τ^b. More detail is provided in appendix a.

An increase in the aid payment shifts both constraints to the right yielding

$$\frac{d\tau^c}{da} = \frac{1}{\delta V_\tau^N(\tau^c)} < 0 \text{ for } \tau^c < \tau^* \text{ and } \frac{d\tau^c}{da} = -\frac{\delta\beta}{V_\tau^S(\tau^c)} < 0 \text{ for } \tau^c > \tau^* \,. \tag{4}$$

To summarize, the applied tariff rate that satisfies incentive compatibility increases in the bound rate while for a given tariff binding it declines in the level of aid. In the model developed so far, governments can try to induce the joint optimal tariff as applied tariff rate, i.e. $\tau^c = \tau^*$, by setting the bound rate accordingly. If both countries stick to the trigger strategies, the bound rate is never actually chosen and therefore does not induce any payoff costs for both governments. This outcome in which the bound rate never materializes and countries can expect with certainty that they will be able to imply the cooperative solution, however, appears to be somewhat unrealistic. Instead, we may think of several real-world situations in which self-enforcing contracts do not come into being. For example, it could be that *(i)* political conflicts might prevent aid payments between two countries, that *(ii)* no appropriate aid projects can be found, or *(iii)* that some governments may be short sighted or regarded as unreliable, etc. To account for this possibility in a tractable and straightforward manner, we assume in the following that a self-enforcing mechanism for trade liberalization and aid can be established only with a certain *ex ante* probability ρ. Otherwise, the country in the South sets the tariff at the bound rate τ^b and receives no aid. In addition, we allow side-payments between N and S in the tariff negotiations. With these assumptions, governments set the bound and cooperative tariff rates such that the expected aggregate per period payoff of both countries is maximized, which is defined as $EW = \rho[V_N(\tau^c) + V_S(\tau^c) + (\beta - 1)a] + [1 - \rho][V_N(\tau^b) + V_S(\tau^b)]$.

In this setting, an interior optimum can only exist if $\tau^c < \tau^*$. Otherwise both countries could increase EW by negotiating a lower tariff binding that also induces a lower τ^c and thereby raise their aggregate payoff.[8] Only the incentive compatibility constraint for the North (2) is binding in such an interior optimum. The optimum tariff binding and the resulting cooperative tariff rate can be found by maximizing EW over τ^b given that $\tau^c = \tau^{\mathrm{Nc}}(\tau^b)$ according to constraint (2) in equality form. From the first-order conditions for an interior solution of this problem, we obtain the following expression:

$$[\rho - 1]A(\tau^b) = \rho A(\tau^c), \quad \text{with } A(\tau) \equiv -\frac{V_\tau^N(\tau) + V_\tau^S(\tau)}{V_\tau^N(\tau)} \,. \tag{5}$$

[8]In our model, governments prefer to keep tariff bindings low as these bindings may determine the actual tariff rates. In a framework that incorporates risk about tariff rates, low bindings may also improve welfare due to stimulating market entry and trade (Sala et al., 2010; Handley, 2014).

It is assumed that $A_\tau(\tau) < 0$, which is sufficient for the second order condition to be satisfied (as shown in appendix a). Conditions (5) and (2) determine both tariff rates, implying $\tau^c < \tau^* < \tau^b$.[9] This outcome results from the fact that with probability π countries do not cooperate and set the predetermined bound rate.

While equation (4) has shown the effects of a change in the aid level ex post, i.e., after the bound rate has been set, equations (5) and (2) can be used to determine the ex ante influence of aid on the bound rate and the resulting applied rate. Totally differentiating these equations yields

$$\frac{d\tau^b}{da} = -\frac{\rho A_\tau(\tau^c)}{\rho\delta A_\tau(\tau^c)V_\tau^N(\tau_b) + (1-\rho)\delta A_\tau(\tau^b)V_\tau^N(\tau_c)} > 0\ . \tag{6}$$

Ex ante, the influence of a change in the aid level is smaller than the ex-post effect set out in expression (4) but still negative:

$$\frac{d\tau^c}{da} = \frac{(1-\rho)A_\tau(\tau^b)}{\rho\delta A_\tau(\tau^c)V_\tau^N(\tau_b) + (1-\rho)\delta A_\tau(\tau^b)V_\tau^N(\tau_c)} < 0\ . \tag{7}$$

To obtain further comparative static results, we specify a simple partial equilibrium setting with linear demand and supply curves as in Bagwell and Staiger (2005) or Beshkar and Bond (2017). The model accounts for importer market power as well as political economy motives as reasons for positive import tariffs. Demand in S for the import good q is given by $d_S = n(1-p_S)$, producers in S supply the good according to $q = np_S/2$, producers in country N supply the good according to $q_N = p_N$, and demand in N is given by $d_N = 1 - p_N$. The term n accounts for the relative market size (and market power) of S. The tariff inserts a wedge between prices in S and in N, i.e., $p_S = p_N + \tau$. Equilibrium prices and imported quantities of S, $m_S = d_S - q_S$, are given by

$$p_S = \frac{2+2n+4\tau}{4+3n}\ ,\quad p_N = \frac{2+2n-3n\tau}{4+3n}\ ,\quad \text{and}\quad m_S = \frac{n(1-6\tau)}{4+3n}\ . \tag{8}$$

Imports are positive as long as $\tau < 1/6$. Producer and consumer surplus in the North depend on the tariff rate according to

$$\pi_N = \frac{(2+2n-3n\tau)^2}{2\,(4+3n)^2} \quad \text{and} \quad \pi_N^d = \frac{(2+n+3n\tau)^2}{2\,(4+3n)^2}\ . \tag{9}$$

[9] As constraint (2) requires $\tau^b > \tau^c$, equation (5) can only be satisfied if $V_\tau^N(\tau^b) + V_\tau^S(\tau^b) < 0$ and $V_\tau^N(\tau^c) + V_\tau^S(\tau^c) > 0$.

Producer and consumer surplus as well as tariff revenues in the South are given by

$$\pi_S = \frac{n\,(1+n+2\tau)^2}{(4+3n)^2}\ , \pi_S^d = \frac{n\,(2+n-4\tau)^2}{2\,(4+3n)^2}\ , \ \text{ and } \ T_S = \frac{\tau n\,(1-6\tau)}{4+3n}\ . \tag{10}$$

The government in N maximizes the sum of producer and consumer surplus. The government in S considers producer surplus, consumer surplus and tariff revenues in its objective function. We assume that the government in S places a relatively higher weight on the surplus of its import-competing producers due to political considerations. That is, the objective function of the government in the South with regard to this particular trading relationship is $V_S = \lambda\pi_S + \pi_S^d + T_S$, with $\lambda > 1$, while that in the North is $V_N = \pi_N + \pi_N^d$. An increase in the tariff rate has the following effects on government objectives in country N:

$$V_\tau^N(\tau) = \frac{3n^2\,(6\tau-1)}{(4+3n)^2}\ . \tag{11}$$

According to (11), V_τ^N is negative for all non-prohibitive τ. The marginal influence of the tariff rate on $V^S(\tau)$ given by

$$V_\tau^S(\tau) = \frac{4(\lambda-1)n(1+n) + 3n^2 + 4n\tau[2(\lambda-1) - 3(2+3n)]}{(4+3n)^2}\ . \tag{12}$$

We assume that λ is not too large, such that the term in squared brackets in the numerator of (12) is negative.[10] With this assumption, $V^S(\tau)$ is first increasing and then decreasing in τ and has an interior maximum at

$$\hat{\tau} = \frac{4(\lambda-1)(1+n) + 3n}{12(2+3n) - 8(\lambda-1)}\ , \tag{13}$$

the optimum tariff rate from the view of an individual country in S. From the view of both countries together, $V^S(\tau) + V^N(\tau)$ has its maximum at:[11]

$$\tau^* = \frac{2(\lambda-1)(1+n)}{12+9n-4(\lambda-1)}\ . \tag{14}$$

While for $\lambda = 1$ free trade ($\tau^* = 0$) would be jointly optimal, the tariff rate τ^* is positive for $\lambda > 1$. The joint optimal tariff rate increases in the political weight of the importer industry λ and in the market size of the importer country n. Given the functional specifications of our example, the incentive compatibility constraints for country S and

[10] This term is negative if $2\lambda < 8 + 9n$. The requirement is satisfied for all positive n if $\lambda \leq 4$.

[11] For an interior optimum, the joint optimum tariff has to be lower than the prohibitive tariff. With (14), it can be shown that this requires $\lambda < 7/4$.

country N can be written in equality form as

$$\frac{n(\tau^b - \tau^c)[4(\lambda-1)(1+n) + 3n + 4(\lambda - 4 - 6n)(\tau^b + \tau^c)]}{(4+3n)^2} = \delta\beta a \tag{1'}$$

and

$$\frac{3\delta n^2(\tau^b - \tau^c)[1 - 3(\tau^b + \tau^c)]}{(4+3n)^2} = a \ , \tag{2'}$$

while the term $A(\tau)$ in the first order condition (5) becomes

$$A(\tau) \equiv \frac{4(\lambda-1)(1+n)(\tau^* - \tau)}{3n\tau^*(1-6\tau)} \ . \tag{5'}$$

Differentiating equation (5') reveals that the requirement $A_\tau < 0$ is satisfied in this model specification. Figure 2 shows how the bound tariff rate in an interior optimum is determined. From the objective function *WE*, we can derive iso-payoff curves, which are ellipses around the unconstrained optimum at which $\tau^b = \tau^c = \tau^*$. In an interior equilibrium, governments choose a point on the reaction curve τ_N^c at which the aggregate payoff is maximized. The tangency point between an iso-payoff curve and the τ_N^c-curve determines the optimal bound rate and the applied tariff rate.

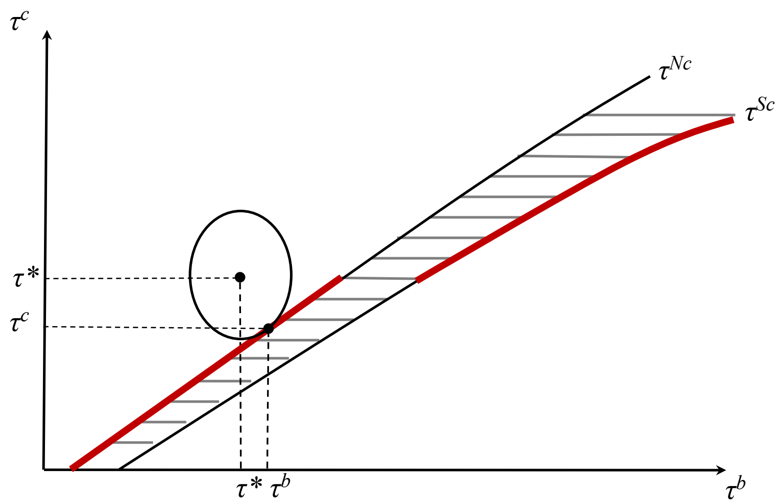

Figure 2: Tariff Outcome

For a comparative static analysis of the tariff outcome, we begin with the situation ex post. In this case, the incentive constraint (2') for country N determines the applied rate. Totally differentiating (2') reveals the following effects:

$$\frac{d\tau^c}{d\tau^b} = \frac{1-6\tau^b}{1-6\tau^c} > 0 \ , \quad \frac{d\tau^c}{da} = -\frac{(4+3n)^2}{3\delta n^2 (1-6\tau^c)} < 0 \ , \quad \text{and}$$
$$\frac{d\tau^c}{dn} = \frac{8(\tau^b-\tau^c)\left[1-3(\tau^b+\tau^c)\right]}{n\,(4+3n)\,(1-6\tau^c)} > 0 \ . \tag{15}$$

An increase in the bound rate raises the applied rate, but as $d\tau^c/d\tau^b < 1$, the tariff overhang increases. An increase in the aid level makes it more costly for the North to stick to the cooperative outcome. As a result, incentive constraint N shifts to the right, and the applied rate has to be lowered accordingly. In contrast, a larger market size of country S makes cooperation more attractive for country N such that its incentive constraint shifts to the left and the applied rate increases. Finally, for a given bound rate, the political weight of importers λ in country S does not affect the incentive constraint for country N and therefore has no impact on the applied rate.

Ex ante, governments can adjust the bound rate in response to a change in exogenous variables. If the aid level increases, governments raise the bound rate to limit the decline in the applied rate ex post and arrive at a new tangency point with the shifted incentive constraint for N, i.e., $d\tau^b/da > 0$.[12] An increase in the political weight has consequences for the joint optimum tariff and the iso-payoff curves. Governments prefer a higher joint tariff τ^* such that the tangency point with the incentive constraint shifts upwards and to the right, resulting in a higher bound rate, $d\tau^b/d\lambda > 0$. An increase in the market power may raise or reduce the bound rate.

4 Tariff data

To empirically examine our model, the investigation is performed using Uruguay agreement tariff data for WTO aid recipients. Specifically, we use 2005-2013 tariff data as the Uruguay agreement was implemented in its entirety in the year 2005 and was succeeded by the Doha agreement in 2014.[13] The tariff data is from the most comprehensive and detailed data set available, the UNCTAD TRAINS data base. Our data includes all countries participating in the Uruguay negotiations and most of the countries that were WTO members by 2013.[14] In this section, we start out describing product tariff data for WTO members under the Uruguay agreement and then turn to present product tariff

[12] See appendix b for a derivation of these results.

[13] The implementation of the agreement started on 1st January 1995 and ended for sensitive agricultural and textile products on 1st January 2005.

[14] Data is lacking for countries that became WTO members in 2012 or 2013 (Laos, Montenegro, Russia, Samoa, Tajikistan and Vanuatu).

characteristics for aid recipients in this category and our country sample in particular. Product tariff data is reported in the common nomenclature used in negotiations, the 6-digit level of the Harmonized System classification.[15]

The product tariff overhang equals the gap, in percentage points, between the importer's bound (BND) and most-favored-nation (MFN) product tariff. This gap can be positive, equal to zero in case of binding MFN rates, or negative. Almost all tariff implementations fall into the first two categories in adherence to WTO regulation depicting that a country can only temporarily deviate from negotiated tariff rates (using 'safeguard measures' to avoid serious damage otherwise caused by an import surge). Binding MFN product tariffs (zero overhang) are reported for 20 percent of the observations and 76 percent of MFN product tariffs are set below their bounds. The share of binding tariffs accounts for 48 percent in developed (OECD) countries compared to only 15 percent in developing (non-OECD) countries, which is consistent with stylized evidence that developing countries are overrepresented in the utilization of tariff overhangs (see, e.g., WTO, 2009). There is a strong correlation between the tariff overhang and the bound tariff ($\rho = 0.88$) and a weak correlation between the tariff overhang and the MFN tariff ($\rho = 0.03$), implying that the use of bounds gives governments considerable flexibility.

Countries often do not use any of the leeway given by set bounds; zero MFN tariffs are adopted for almost 1 out of 5 products. In contrast, tariff bounds are very large (exceeding 100 percent) for a small subset of observations (1.6 percent), comprising almost entirely developing countries. MFN tariffs are sometimes left unbound in the negotiations, which leaves countries with full flexibility under the agreement. This doesn't impact the country-product-year means that we analyze much as the correlation is very high between aggregate bound and overall MFN tariff rates ($\rho = 0.97$). In line with this paper's scope, we focus on bound MFN tariffs.

In Table 1, we report descriptive tariff statistics for WTO members under the Uruguay agreement. Tariff overhangs are often large in relation to MFN rates. The average tariff overhang is 28.1 percentage points, which provides governments with substantial leeway to increase protection without breaching the agreement. Evaluated at the average MFN rate of 9.4 percent, the applied tariff rate can therefore be almost tripled without allowing for retaliatory response under WTO regulation. A breakdown into developed and developing countries shows that these figures reflect the large share of developing countries (84 percent). Developing countries have higher average tariff overhangs, BND and MFN tariffs than developed countries. The discrepancy is large with developing countries using five times as large tariff overhangs, almost four times as large bounds and

[15]The 2005-2013 HS6 tariff data is reported in different versions of the classification and has been matched to conform to one version using concordance tables from the UN Statistics Division.

twice as large applied tariffs. The applied tariff rates are stable in the investigated time period.

Table 1: WTO members under Uruguay agreement - tariff descriptive statistics

	Tariff overhang (pp)		BND tariff (%)		MFN tariff (%)	
Sample	Mean	STD	Mean	STD	Mean	STD
Total	28.1	27.3	38.2	29.6	9.4	5.0
Developed	6.0	7.3	10.7	10.2	4.9	3.0
Developing	30.7	27.8	41.4	29.6	10.0	4.9

Note: Country-product-year means reported.

In Table 2, we present tariff data summary statistics for WTO members that were aid recipients under the Uruguay agreement and those of these members that participated in the Uruguay negotiations.[16] The tariff characteristics are representative of the full sample of WTO members in the developing country category (presented in Table 1). Uruguay round participants display slightly higher tariff overhangs and bound and applied tariff rates compared to new members in line with previous evidence that countries that joined the WTO after the Uruguay round was finalized faced stricter negotiation conditions (Evenett and Primo Braga, 2006, Beshkar et al., 2015). As it is evident that the tariff data is inconsistent with assumptions underlying standard estimation techniques, these are transposed into natural logarithms in the empirical investigation.

Table 2: WTO aid recipient members under Uruguay agreement - tariff descriptive statistics

	Tariff overhang (pp)		BND tariff (%)		MFN tariff (%)	
Sample	Mean	STD	Mean	STD	Mean	STD
Total	28.9	27.5	39.1	29.8	10.2	5.5
Round	32.9	27.5	43.5	29.8	10.6	5.7

Note: Country-product-year means reported.

[16]The aid recipients that became members after the Uruguay round are Albania, Armenia, Cambodia, Cape Verde, China, Democratic Republic of Congo, Ecuador, Georgia, Jordan, Kyrgyz Republic, Laos, Macedonia, Moldova, Mongolia, Montenegro, Nepal, Oman, Panama, Samoa, Tajikistan, Tonga, Ukraine, Vietnam, and Vanuatu

5 Empirics

We bring our theory to data by examining how key model parameters, i.e., the aid level a, the importer market power n and the political weight of import-competing producer interests λ influences the negotiated bound tariff rate τ^b and the applied tariff rate τ^c under the agreement. To sum up, governments that receive more aid negotiate a higher bound tariff rate $d\tau^b/da > 0$ and use a lower applied tariff rate $d\tau^c/da < 0$, governments act on terms-of-trade related incentives in the negotiations $d\tau^b/dn \neq 0$ and those with stronger importer market power levy a higher applied tariff rate $d\tau^c/dn > 0$. Finally, governments that favor import-competing interests negotiate a higher bound tariff rate $d\tau^b/d\lambda > 0$. To test these predictions, and the one that a higher set bound tariff rate induces a higher applied tariff rate $d\tau^c/d\tau^b > 0$, we investigate bound and applied tariff formation directly under tariff overhang $\tau^b > \tau^c$. Operationalizing the model, the parameter values a, n and λ under the negotiations determine the tariff bound τ^b under the subsequent agreement and the applied tariff τ^c is determined by the set value of τ^b under the agreement as well as by a and n parameter values. In addition, the economic development level is added to our specifications to control for possible impacts of development-related factors outside the model.

In the empirical setup, τ^c, a and n are continuous variables and τ^b (that is fixed) and λ (that is constructed from time-invariant data) are constants. Periods take the form of 3-year intervals roughly corresponding to the International Development Association (IDA) replenishment cycles used to program World Bank aid donations (Galiani et al., 2017), which form a reasonable approximation of timing in the repeated aid-for-trade game as the World Bank contributes a large share of global aid donations (50 percent in 2005) and its aid programs regularly guide decisions of other donors. Continuous variables are measured in 3-year means capturing the end (and thrust) of the negotiations, which is the 1992-1994 period for Uruguay round participants and the period leading up to WTO accession for new members, or the 2005-2007, 2008-2011 and 2011-2013 agreement periods.[17] In line with the scope of our model, the applied tariff rate is measured by the unbinding MFN tariff rate. The aid level is measured by net official development assistance (ODA), which is defined as government aid given to developing countries, in natural logarithms of USDs.[18] The importer market power is measured by the GDP level (Broda et al., 2008) in natural logarithms of USDs. The political weight placed on import-competing interests is measured by a political organization indicator taking the value one if there are importer trade associations. Following Ludema and Mayda (2013), political

[17]The time periods between the start of negotiations and accession, which vary widely between countries, often exceed three years.

[18]We consider genuine aid, excluding countries that use their foreign aid for internal purposes.

organization industry indicators are constructed using trade association listings in the World Guide to Trade Associations and importer data from the UNCTAD COMTRADE data base.[19] The trade association listings are reported for the year 1998, which could be argued to give a reasonable approximation of the organizational behavior of import-competing interests over the investigated time period as the political organization of these interests is highly persistent over time due to a combination of high organizational costs and large net gains from influencing policy (Olson, 1965). The economic development level is measured by the GDP per capita level in natural logarithms of USDs. ODA, GDP and population data (used to calculate GDP per capita levels) come from the World Bank WDI data base.

Our investigation includes a predominant share of aid recipients that were GATT/WTO members under the Uruguay negotiations and agreement. The data set of GATT aid recipients participating in the Uruguay negotiations includes 87 out of 91 countries, which marginally over represents the poorest countries that are most dependent on aid. In comparison, the included countries get larger aid donations and have marginally higher mean BND tariff rates (47 percent) and tariff overhangs (33 percentage points) than excluded countries. These discrepancies may bias the a parameter estimate upwards. Our data set of WTO aid recipients under the Uruguay agreement includes 104 out of 109 countries, which have aid levels similar to excluded countries.[20] This country sample is restricted further as two countries have negative tariff overhang,[21] trade association information is lacking for one country and instrumental variables are available for a subsample of 92 countries. The unrestricted and restricted samples display almost identical (unbinding and standard) MFN rates and similar BND tariff rates and tariff overhangs, indicating that the IV estimation sample is representative. In appendix c, countries used in our empirical investigation are listed in Table A1 and data summary statistics are reported in Table A2.

The BND tariff specification is estimated using OLS and the MFN tariff specification is estimated using generalized least squares (random-effects) with and without instrumental variables supporting endogenous model parameters (a and n). The use of these methods is consistent with predicted level relationships and founded on the data as the BND tariff rate is set and the MFN tariff rate displays little variation in the investigated time period. We turn to the model and prior evidence to find suitable instruments for the aid level, importer market power and economic development. As the model depicts continued aid

[19]The industry category matching, which relies on subjective judgement (as the listings are not reported in any standard classification), is available upon request.

[20]We lack tariff data for these countries.

[21]These countries are Cote d'Ivoire and Vietnam, which also display very low BND tariff rates and aid levels.

payments as a central feature of the aid-for-trade game, the country's aid level at (the end of) the Uruguay negotiations is used as an aid instrument. We also draw on a recent contribution by Galiani et al. (2017), where the authors provide an indicator aid instrument capturing if the country crosses the IDA aid eligibility income threshold used as a guideline to program future aid allocations. Specifically, we construct an indicator variable taking the value one if the country crosses the aid eligibility threshold from above under the Uruguay negotiations. The importer market power instrument is the land area, which expands a country's production opportunities and market size (Frankel and Romer, 1999; Hausmann et al., 2007). The economic development instrument is the "financial depth", i.e., the relative size of financial intermediaries, under the negotiations as this sector has been shown to found economic development (Levine, 2005).

Our instruments are exogenous and we argue that they are excludable. There is no indication that recipients of more aid under the negotiations change their economic growth path and affect their economic development in the data. In fact, the economic development ranking of countries is persistent over time with an almost complete correlation between GDP per capita levels under the negotiations and the agreement ($\rho = 0.96$). Similarly, countries that cross the aid eligibility threshold cannot be expected to be on a systematically different economic growth path than other countries. We find no reason to expect the land area or financial depth instruments to affect applied tariff formation via other channels in the economic development literature. The aid eligibility indicator is constructed from annual eligibility thresholds and GNI per capita data in USDs (calculated with the Atlas method) reported by the World Bank. The land area is measured in natural logarithms of squared kilometers using data from the World Bank WDI data base. The financial depth variable is a composite IMF index comprising data on private-sector credit to GDP, pension fund assets to GDP, mutual fund assets to GDP and insurance premiums to GDP (Svirydzenka, 2016).

Results of the bound tariff estimations are presented in Table 3. Empirical model performances are fine and parameter coefficients receive expected signs and statistical support confirming our model predictions. Governments that receive more aid negotiate higher bounds, governments with stronger importer market power reduce their tariff bounds and governments that face politically organized importer interests negotiate higher bounds in line with theory. Estimation results are almost identical for a restricted sample of GATT members (excluding new members after the Uruguay round) and an unrestricted sample of WTO members under the Uruguay agreement. In fact, our results indicate that new members are not more restricted than Uruguay round participants controlling for model parameters. The aid level is a key determinant of the BND tariff rate. A one percent increase in aid receipts increases the tariff bound by more than

0.52 percent. The effect of the import-competing sector's political organization on the tariff bound is very large indicating that these interests strongly influenced the Uruguay agreement. The level of economic development is unimportant in explaining BND tariff variation, which indicates that our model fully captures development-related factors affecting tariffs negotiated in the Uruguay round.

Table 3: Bound tariff estimation results

Sample	GATT	GATT	WTO	WTO	WTO
a	0.605***	0.538***	0.593***	0.606***	0.529***
	(0.163)	(0.092)	(0.153)	(0.155)	(0.089)
n	-0.463***	-0.426***	-0.467***	-0.461***	-0.430***
	(0.115)	(0.088)	(0.109)	(0.109)	(0.082)
λ	1.000**	1.025**	1.088**	0.975**	1.097**
	(0.427)	(0.423)	(0.365)	(0.398)	(0.363)
GDP per capita	0.109		0.106	0.113	
	(0.218)		(0.204)	(0.204)	
New member				-0.495	
				(0.690)	
R-squared	0.365	0.363	0.363	0.375	0.369
Nobs	87	87	92	92	92

Notes: GATT members participated in the Uruguay round. WTO countries includes (all) members under the Uruguay agreement. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

In Table 4, we present the applied tariff estimation results. The parameter results are strongly affected by the use of instrumental variables indicating that endogeneity problems need to be accounted for. The selected instruments pass a Sargan-Hansen test further validating the IV estimation results. We will therefore use the IV results to analyze our model performance. Parameter estimates obtain the expected signs and are statistically supported. Governments that negotiate higher tariff bounds use higher applied tariffs, governments with larger aid receipts use lower applied tariffs to incentivize continued aid donations and governments that have stronger importer market power increase their applied tariff in line with prior evidence. The aid result provides strong support of our aid-for-trade model. It should be noted that the exchange of market access for aid relies on the existence of tariff overhang (i.e. as binding MFN tariff rates increases with the aid level under negotiations). The aid elasticity is in parity with the tariff bound elasticity. A one percent increase in aid receipts or reduction in the tariff bound reduces the applied tariff by at least 0.35 percent. The political organization of import-competing interests is unimportant in explaining the applied tariff rate with the bound tariff rate taken into account. The result is consistent with the view that governments use tariff bounds to stall off the political influence of import-competing interests (Maggi and Rodriguez-Clare, 2007).

Table 4: Applied tariff estimation results ($\tau^b > \tau^c$)

	GLS	GLS	GLS(IV)	GLS(IV)
τ^b	0.445***	0.467***	0.358***	0.396***
	(0.069)	(0.060)	(0.077)	(0.063)
a	-0.083**	-0.079**	-0.430**	-0.376**
	(0.033)	(0.032)	(0.178)	(0.162)
n	0.038	0.039	0.248***	0.225***
	(0.028)	(0.026)	(0.090)	(0.079)
λ	-0.003		-0.070	
	(0.117)		(0.121)	
GDP per capita	-0.164***	-0.153***	-0.574***	-0.506**
	(0.050)	(0.049)	(0.216)	(0.198)
Time effects	X	X	X	X
R-squared	0.434	0.451	0.318	0.358
No of countries	101	102	91	91
Nobs	254	257	229	232
Sargan-Hansen test (p)			0.311	0.311

Notes: The applied tariff rate is measured by the unbinding MFN tariff. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

6 Conclusions

In this paper, we identified and analyzed development aid as a possible explanation for tariff overhangs, i.e., for gaps between negotiated tariff ceilings and actual tariff rates. Tariff overhangs can be seen as collateral to induce aid payments from developed to developing countries. In a simple theoretical model that combines voluntary cooperation on trade and aid policies in an infinite horizon framework with negotiations on tariff ceilings, we derived clear predictions on the relationship between aid and tariff overhangs. The tariff bound increases in the aid level to ensure incentive compatibility for developed countries to pay aid. We also determined the optimal combination of aid and tariff bound maximizing joint welfare under an international agreement. In our empirical analysis, we examined tariffs under the Uruguay agreement to test the predicted relationships between aid payments, tariff bounds and applied (MFN) tariffs using a data set including a predominant majority of the aid recipients that participated in the Uruguay round. Our empirical results are strongly supportive of our aid-for-trade model; governments that receive more aid negotiate larger bounds and adopt lower applied tariffs.

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Appendix a: Second order condition and possible corner solution

The Lagrangian for the maximization of EW subject to constraint (2) is given by

$$\mathcal{L}(\tau^c, \tau^c, \lambda) = EW(\tau^b, \tau^c) + \lambda\{a - \delta V^N(\tau^c) + \delta V^N(\tau^b)\} \; . \tag{A.1}$$

The first order conditions for this maximization are

$$\begin{aligned} \mathcal{L}_{\tau^c} &= \rho[V_\tau^S(\tau^c) + V_\tau^N(\tau^c)] - \lambda\delta V_\tau{}^N(\tau^c) = 0 \\ \mathcal{L}_{\tau^b} &= (1-\rho)[V_\tau^S(\tau^b) + V_\tau^N(\tau^b)] + \lambda\delta V_\tau{}^N(\tau^b) = 0 \\ \mathcal{L}_\lambda &= a - \delta V^N(\tau^c) + \delta V^N(\tau^b) = 0 \; . \end{aligned} \tag{A.2}$$

The bordered Hessian is given by

$$\bar{H} = \begin{pmatrix} 0 & \delta V_\tau^N(\tau^c) & -\delta V_\tau^N(\tau^b) \\ \delta V_\tau^N(\tau^c) & \rho[V_{\tau\tau}^S(\tau^c) + V_{\tau\tau}^N(\tau^c)] - \lambda\delta V_{\tau\tau}^N(\tau^c) & 0 \\ -\delta V_\tau^N(\tau^b) & 0 & (1-\rho)[V_{\tau\tau}^S(\tau^b) + V_{\tau\tau}^N(\tau^b)] + \lambda\delta V_{\tau\tau}^N(\tau^b) \end{pmatrix}, \tag{A.3}$$

which yields after inserting

$$\begin{aligned} \det \bar{H} = &-(\delta V_\tau^N(\tau^b))^2\rho\left[V_{\tau\tau}^S(\tau^c) + V_{\tau\tau}^N(\tau^c) - \frac{V_{\tau\tau}^N(\tau^c)(V_\tau^S(\tau^c) + V_\tau^N(\tau^c))}{V_\tau^N(\tau^c)}\right] \\ &-(\delta V_\tau^N(\tau^c))^2(1-\rho)\left[V_{\tau\tau}^S(\tau^b) + V_{\tau\tau}^N(\tau^b) - \frac{V_{\tau\tau}^N(\tau^b)(V_\tau^S(\tau^b) + V_\tau^N(\tau^b))}{V_\tau^N(\tau^b)}\right] \; . \end{aligned} \tag{A.4}$$

The second order condition for a maximum, $\det \bar{H} > 0$, is satisfied if the terms in squared brackets in (A.4) are negative. This is the case for $A_\tau < 0$.

Figure 1 depicts the case in which $\tau^{Nc}(\tau^b)$ of constraint (2) exceeds $\tau^{Sc}(\tau^b)$ for all relevant τ^b. Both constraints may, however, also intersect. In this case, constraint N is steeper than constraint S at the intersection point. This follows from the assumption $A_\tau(\tau) < 0$, which implies

$$\frac{V_\tau^N(\tau^b)}{V_\tau^N(\tau^{Nc})} > \frac{V_\tau^S(\tau^b)}{V_\tau^S(\tau^{Sc})} \tag{A.5}$$

at $\tau^{Nc} = \tau^{Sc}$. The situation may be depicted as in figure A.1. In this case, a corner solution may exist at the intersection of constraints (1) and (2).

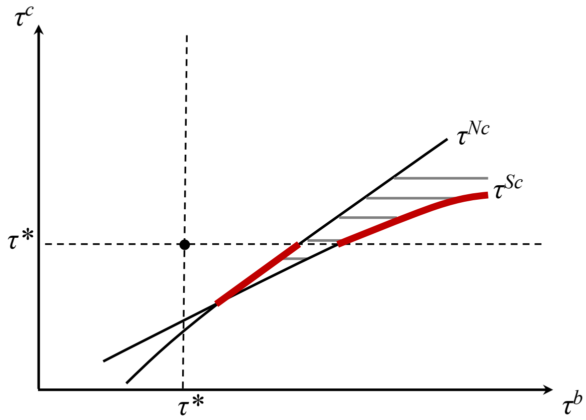

Figure A.1: Incentive Constraints Intersect

Appendix b: Comparative statics

Totally differentiating equations (2) and (5) leads to the following expression:

$$\begin{pmatrix} \rho A_\tau(\tau^c) & (1-\rho)A_\tau(\tau^b) \\ \delta V_\tau^N(\tau^c) & -\delta V_\tau^N(\tau^b) \end{pmatrix} \begin{pmatrix} d\tau^c \\ d\tau^b \end{pmatrix} =$$
$$\begin{pmatrix} -[\rho A_\lambda(\tau^c) + (1-\rho)A_\lambda(\tau^b)]d\lambda - [\rho A_n(\tau^c) + (1-\rho)A_n(\tau^b)]dn \\ da - [\delta V_n^N(\tau^c) - \delta V_n^N(\tau^b)]dn \end{pmatrix}, \quad \text{(A.6)}$$

with

$$A(\tau) = \frac{4(\lambda-1)(1+n) - 2\tau[12+9n-4(\lambda-1)]}{3n(1-6\tau)}$$

and

$$V^N(\tau, n) = \frac{4(1+n)^2 + (2+n)^2 - 6n^2\tau[1-3\tau]}{2(4+3n)^2} .$$

Taking the derivative yields

$$A_\tau(\tau) = \frac{2(4\lambda-7)(4+3n)}{3n(1-6\tau)^2} < 0 \text{ for } \lambda < 7/4 . \quad \text{(A.7)}$$

The influence of an increase in a has already been determined in (6) and (7). An increase in λ has the following effects on tariff rates:

$$\frac{d\tau^c}{d\lambda} = -\frac{[\rho A_\lambda(\tau^c) + (1-\rho)A_\lambda(\tau^b)]V_\tau^N(\tau^b)}{\rho A_\tau(\tau^c)V_\tau^N(\tau^b) + (1-\rho)A_\tau(\tau^b)V_\tau^N(\tau^c)} > 0 \quad \text{(A.8)}$$

and

$$\frac{d\tau^b}{d\lambda} = -\frac{[\rho A_\lambda(\tau^c) + (1-\rho)A_\lambda(\tau^b)]V_\tau^N(\tau^c)}{\rho A_\tau(\tau^c)V_\tau^N(\tau^b) + (1-\rho)A_\tau(\tau^b)V_\tau^N(\tau^c)} > 0 ,$$

with

$$A_\lambda = \frac{4(1+n+2\tau)}{3n(1-6\tau)} > 0 \ .$$

For the influence on the tariff overhang, we obtain

$$\frac{d\tau^b}{d\lambda} - \frac{d\tau^c}{d\lambda} = -\frac{[\rho A_\lambda(\tau^c) + (1-\rho)A_\lambda(\tau^b)][V_\tau^N(\tau^c) - V_\tau^N(\tau^b)]}{\rho A_\tau(\tau^c)V_\tau^N(\tau^b) + (1-\rho)A_\tau(\tau^b)V_\tau^N(\tau^c)} > 0 \ , \qquad \text{(A.9)}$$

since V_τ^N increases in τ. For an increase in n, finally, equation (A.6) yields

$$\frac{d\tau^c}{dn} = -\frac{[\rho A_n(\tau^c) + (1-\rho)A_n(\tau^b)]V_\tau^N(\tau^b) + (1-\rho)A_\tau(\tau^b)[V_n^N(\tau^c) - V_n^N(\tau^b)]}{\rho A_\tau(\tau^c)V_{N\tau}(\tau^b) + (1-\rho)A_\tau(\tau^b)V_{N\tau}(\tau^c)} \qquad \text{(A.10)}$$

and

$$\frac{d\tau^b}{dn} = \frac{[\rho A_\tau(\tau^c)[V_n^N(\tau^c) - V_n^N(\tau^b)] - [\rho A_n(\tau^c) + (1-\rho)A_n(\tau^b)]V_\tau^N(\tau^c)}{\rho A_\tau(\tau^c)V_\tau^N(\tau^b) + (1-\rho)A_\tau(\tau^b)V_\tau^N(\tau^c)} \ ,$$

where

$$V_n^N(\tau^c) - V_n^N(\tau^b) = -\frac{24n(\tau^c - \tau^b)[1 - 3(\tau^c + \tau^b)]}{[4+3n]^3} > 0$$

and

$$A_n(\tau) = \left(-\frac{4}{n^2}\right)\frac{\lambda - 1 + 2\tau(\lambda - 4)}{3\,(1-6\tau)} \ .$$

After inserting from f.o.c. (5), the term $\rho A_n(\tau^c) + (1-\rho)A_n(\tau^b)$ in (A.10) can be written as follows:

$$\rho A_n(\tau^c) + (1-\rho)A_n(\tau^b) = \rho A(\tau^c)\left[\frac{A_n(\tau^c)}{A(\tau^c)} - \frac{A_n(\tau^b)}{A(\tau^b)}\right] \ . \qquad \text{(A.11)}$$

With $A_n(\tau)$ from (A.10) and $A(\tau)$ from (A.6), we can write

$$\frac{A_n(\tau)}{A(\tau)} = -\frac{2\lambda - 2 + 4\tau(\lambda - 4)}{x + \tau y} \ ,$$

with $x \equiv 2n(\lambda - 1)(1+n)$ and $y \equiv n[4(\lambda - 1) - 12 - 9n]$, such that

$$\frac{A_n(\tau^c)}{A(\tau^c)} - \frac{A_n(\tau^b)}{A(\tau^b)} = \frac{2n^2(\lambda - 1)(4\lambda - 7)(\tau^b - \tau^c)}{\{x + \tau^b y\}\{x + \tau^c y\}} > 0 \ , \qquad \text{(A.12)}$$

since $\lambda < 7/4$ has been assumed, $x + \tau^c y > 0$ and $x + \tau^b y < 0$. Therefore, we can conclude that $d\tau^c/dn > 0$, while $d\tau^b/dn$ may be positive or negative.

Appendix c: Country samples and data descriptives

Table A1: Country list

Albania[a], Angola, Antigua and Barbuda, Argentina, Armenia[a], Bangladesh, Barbados, Belize, Benin, Bolivia, Botswana, Brazil, Brunei[c], Burkina Faso, Burundi, Cambodia[b,d], Cameroon, Cape Verde[b], Central African Republic, Chad, Chile, China[a], Colombia, Congo, Dem. Rep.[a], Congo, Rep., Costa Rica, Cote d'Ivoire[c], Croatia[a,d], Cuba[d], Djibouti[d], Dominica, Dominican Republic, Ecuador[a], Egypt, Arab Rep., El Salvador, Fiji, Gabon, Gambia, Georgia[a], Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hong Kong[c], India, Indonesia, Israel[c], Jamaica, Kenya, Kyrgyz Republic[a,d], Lesotho, Macao[c], Macedonia[a,d], Madagascar, Malawi, Malaysia, Maldives[d], Mali, Mauritania, Mauritius, Mexico, Moldova[a,d], Mongolia[a], Morocco, Mozambique, Myanmar[a,d], Namibia, Nepal[b], Nicaragua, Niger, Nigeria, Oman[a], Pakistan, Panama[a], Papua New Guinea, Paraguay[d], Peru, Philippines, Rwanda, Senegal, Sierra Leone, Singapore[c], Solomon Islands, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Swaziland[d], Tanzania, Togo, Tonga[a], Trinidad and Tobago, Tunisia, Turkey[a], Uganda, Ukraine[a], Uruguay, Venezuela, Vietnam[b,c], Zambia, Zimbabwe[d].

Notes: : [a] not in τ^b estimations, [b] not in restricted τ^b estimation (with GATT members), [c] not in τ^c estimations, [d] not in restricted τ^c estimation (with instruments).

Table A.2: Data Summary Statistics

Estimation	Variable	Mean	STD
τ^b	τ^b(logged)	45.7	29.0
τ^b, restricted	τ^b(logged)	47.4	28.9
τ^b	τ^b(logged)	43.7	28.7
τ^b, restricted	τ^b(logged)	45.7	28.9
τ^c	τ^c(logged)	10.43	4.89
τ^c, restricted	τ^c(logged)	10.45	4.56
τ^b	a(logged)	$4.6 \cdot 10^8$	$5.31 \cdot 10^8$
τ^b, restricted	a(logged)	$4.02 \cdot 10^8$	$5.23 \cdot 10^8$
τ^c	a(logged)	$6.06 \cdot 10^8$	$7.60 \cdot 10^8$
τ^c, restricted	a(logged)	$6.53 \cdot 10^8$	$7.88 \cdot 10^8$
τ^b	n(logged)	$3.42 \cdot 10^{10}$	$8.13 \cdot 10^{10}$
τ^b, restricted	n(logged)	$3.41 \cdot 10^{10}$	$8.30 \cdot 10^{10}$
τ^c	n(logged)	$2.62 \cdot 10^{11}$	$1.54 \cdot 10^{12}$
τ^c, restricted	N(logged)	$1.43 \cdot 10^{11}$	$4.8 \cdot 10^{11}$
τ^b	λ	0.793	0.407
τ^b, restricted	λ	0.828	0.380
τ^c	λ	0.762	0.427
τ^c, restricted	λ	0.781	0.414
τ^b	Development(logged)	2488	3891
τ^b, restricted	Development(logged)	2560	3983
τ^c	Development(logged)	4128	4785
τ^c, restricted	Development(logged)	3907	4069
τ^c, restricted	Initial aid level(logged)	$4.15 \cdot 10^8$	$5.05 \cdot 10^8$
τ^c, restricted	Crossing from above	0.11	0.32
τ^c, restricted	Land(logged)	664831	1359901
τ^c, restricted	Financial depth	0.12	0.14

Notes: The restricted τ^b estimation includes only GATT members. The restricted τ^c estimation is limited by instrumental variable data availability.