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**POLICY CHOICE: THEORY AND  
EVIDENCE FROM COMMITMENT VIA  
INTERNATIONAL TRADE  
AGREEMENTS**

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## **ABSTRACT**

### **Policy Choice: Theory and Evidence from Commitment via International Trade Agreements**

Why do governments employ inefficient policies to redistribute income towards special interest groups (SIGs) when more efficient ones are available? To address this puzzle we derive and test predictions for a set of policies where detailed data is available and an efficiency ranking is feasible: tariffs vs. non-tariff barriers (NTBs). In our policy choice model a government bargaining with domestic SIGs can gain by constraining tariffs through international agreements even if this leads to the use of the less efficient NTBs. This generates two key testable predictions (i) there is imperfect policy substitution, i.e. tighter tariff constraints are not fully offset by the higher NTBs they generate and (ii) the decision to commit to constraints depends on the government's bargaining power relative to SIGs. Using detailed data, we confirm that tariff constraints in trade agreements increase the likelihood and restrictiveness of NTBs. We also provide a structural estimate that indicates NTBs are less efficient than the tariffs they imperfectly replace. Moreover, we find parametric and non-parametric evidence that the higher the government bargaining power relative to a SIG the more relaxed the tariff constraint it chooses. This result is stronger for organized industries, which further supports the theory. The main theoretical insights and empirical approach can be applied to other policies to provide additional evidence on inefficient redistribution.

JEL Classification: c7, d7, f13 and h2

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## 1 INTRODUCTION

Many economic policies are enacted as a form of redistribution towards special interest groups (SIGs). This is not puzzling since governments are not social welfare maximizers. What is puzzling is that such redistribution is often done using policies that appear to be inefficient, i.e. policies that reduce the surplus that governments and SIGs can bargain over. Why are instruments such as geographically targeted public projects or production subsidies used for redistribution when, in the absence of specific externalities, lump-sum payments would be more efficient? Why are technical regulations used to restrict trade instead of tariffs; or tariffs used instead of production subsidies? Most theoretical and empirical analysis focuses on a single policy and ignores the existence, choice and use of multiple policies for a given objective. This common use of “partial political equilibrium” models can lead to erroneous normative prescriptions and positive predictions.

There is a growing theoretical literature but almost no empirical work on this important inefficient redistribution puzzle. One reason is that nearly all theories addressing this puzzle model why a particular group prefers inefficient policies but they do *not* model the mechanism through which those preferences are channeled. Thus, as we describe in the next section, these theories do not provide positive predictions for which policy is used in equilibrium. The main contributions of this paper are the following. First, we derive specific predictions based on a model with an explicit mechanism for inefficient policy choice. Second, we test these predictions using detailed data.

More specifically, we build on Drazen and Limão (2008) who provide a theory of policy choice where the government bargains with SIGs over the level of a lump-sum transfer and/or production subsidy. One of their key insights is that the government can benefit from constraints on the relatively efficient policy because while they reduce the *total* surplus they increase the government’s share. Importantly, they also show how the constraints on the efficient policy emerge under alternative first stage choice mechanisms provided the government has some ability to commit to such constraints.

In order to tightly link the theory and estimation we must focus on a specific set of policies. The two constraints are data availability and the ability to rank policies in terms of efficiency. Since there is no detailed data on lump-sum transfers and production subsidies to directly test Drazen and Limão (2008) we must extend it to a different setting. We examine a small country’s choice of alternative trade policies both because these can be ranked in terms of efficiency and because detailed data is available. Moreover, this is a setting where inefficient redistribution is an important puzzle (c.f. Rodrik, 1995) and one where governments have access to a ubiquitous commitment mechanism: international agreements. The World Trade Organization (WTO) generally forbids production subsidies; a relatively

more efficient redistribution policy than tariffs, but allows its members to negotiate and bind tariffs.<sup>1</sup> The WTO's members have typically placed even fewer constraints on various non-tariff barriers (NTBs) that are often even less efficient than tariffs. These NTBs can include quantitative restrictions, product standards, import surcharges, etc, and some argue that as tariffs have fallen they have been replaced with NTBs.<sup>2</sup> In sum, this is an interesting setting for analyzing policy choice in general and one that also allows us to address other important specific questions such as (i) the commitment value of trade agreements for small countries and (ii) the impact of their tariff constraints on the use of NTBs.

We begin by showing that a self-interested government in a small economy can benefit from an international commitment to constrain the relatively more efficient policies (e.g. production subsidies and/or tariffs). Committing to these constraints improves the bargaining position of the government versus the SIG in that sector as it limits the maximum redistribution it can supply for a given "payment" made by that SIG. However, these agreements do not constrain *all* policies so SIGs can generally find some alternative one (e.g. an NTB) that is less efficient but still allows SIGs to exploit any political gains from trade.<sup>3</sup> We show that despite this increase in the use of inefficient policies the government can still benefit from the constraints. The model predicts that a tariff cap increases the likelihood of NTBs and that there is imperfect policy substitution, i.e. tighter tariff caps increase the restrictiveness of NTBs but not enough to offset the tariff reduction. By deriving the structural relationship between the policies we can also provide estimates of the average inefficiency of NTBs.

We then show that governments choose *not* to constrain products in which they have sufficiently high (Nash) bargaining power relative to SIGs. A government with high bargaining power captures most of the total surplus, so reductions in the surplus due to the constraints cannot be offset by an increase in the share the government captures. Moreover, if governments do choose to commit then the model predicts less stringent caps on products where their bargaining power is higher.

We find support for several of the model's predictions by using tariff and non-tariff barriers for about 5,000 goods. To exploit variation in tariff constraints across goods using detailed data we focus on a single country, Turkey. We discuss several reasons for this choice in section 4; one of them is that it allows us to analyze two of the most common types of commitment in tariffs: those imposed via multilateral agreements such as the WTO and via preferential trade agreements (PTAs).

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<sup>1</sup> In the last trade round for example, the percentage of industrial tariff lines subject to bindings increased from 22 to 72 in developing countries, and 18 to 100% in agriculture (Martin and Francois, 1997).

<sup>2</sup> Hillman (1989) states that "(...) because GATT negotiations have succeeded in securing substantial multilateral tariff reductions, non-tariff barriers have in many instances come to replace tariffs as the means for protection." (p. 76). Kee et al (2006) provide *advalorem* equivalent estimates of NTBs for several countries that show they are very trade restrictive.

<sup>3</sup> There may be different reasons for this, one recently emphasized by Maggi, Horn and Staiger (2006) is that it is costly to agree on any single policy and thus trade agreements remain incomplete contracts in order to save on such costs.

Goods with tariff constraints set through the WTO and the PTA with the European Union increase the probability and restrictiveness of NTBs in Turkey. These effects are smaller when the tariff constraint is relaxed, which is precisely what the theory predicts. We find stronger effects for the industries the theory applies to: those organized into SIGs. Moreover, the effects of tariff caps are related to their actual implementation *dates*, suggesting that the existence of a cap is not simply a proxy for some other product characteristics. The results are robust to various issues including endogeneity concerns, which we address using an instrumental variables approach.

We also analyze whether governments choose constraints as predicted by the model. To focus on the model's central mechanism we construct a novel empirical measure of government bargaining power relative to lobbies: their relative probability of survival, as suggested by the theory. We find that the government is less likely to constrain tariffs in the WTO in products where it has high bargaining power. Moreover, we find parametric and nonparametric evidence that the government sets less stringent tariff constraints in goods where it has higher bargaining power. This result is particularly strong for organized industries, as the model predicts, and is robust to endogeneity concerns.

The estimated effects are also economically significant. Turkey's government is more likely to place tariff constraints on products from industries where it has low bargaining power (60%) than in other industries (38%) and those constraints are about 20 percentage points tighter in low bargaining power industries. We estimate that this causes NTB *advalorem* equivalents to rise but not by enough to offset the tariff declines, i.e. we find imperfect policy substitution. Imperfect substitution is a prediction of the model assuming that the NTB is less efficient than the tariff; we provide a structural inefficiency estimate that indicates this assumption is correct.

In sum, the results support key assumptions and predictions of the model. This, and the fact that the key theoretical insights apply to other policies that can be ranked in terms of efficiency, suggests that the model provides a useful lens to analyze the inefficient redistribution puzzle more generally. The structure of the paper is the following. In section 2, we discuss the related literature on policy choice and commitment in trade agreements. In section 3, we introduce the model and derive the testable predictions that we test in section 4. In section 5, we conclude.

## **2 LITERATURE**

This paper spans three topics: the general policy choice puzzle, the value of commitment via trade agreements and the relative efficiency of trade policies. We now briefly discuss each.

## 2.1 Policy Choice

One argument for the use of relatively inefficient policies is that they make redistribution towards SIGs costlier and thus act like “sand in the wheels” of the redistributive process. This sand causes a reduction in the equilibrium amount of redistribution and thus relatively inefficient policies may be preferred from a social welfare perspective. This type of mechanism is employed by Becker and Mulligan (2003), Rodrik (1986) and Wilson (1990) for example. However, these papers provide a normative rather than a positive theory of inefficient transfers since they leave the government in the background and do not model the policy choice process. In contrast, in our approach the government is an active player, and by modeling the first-stage of policymaking we can provide a positive theory of inefficient transfers. This is particularly important given that our main goal is to test the model.<sup>4, 5</sup>

The other prominent argument is the “disguised” transfer idea put forward by Tullock (1983). Those who bear the costs of funding a certain policy may be ignorant of its redistributive effects to SIGs and thus less likely to oppose it if the policy also has some social benefit. Coate and Morris (1995) formalize this idea and show that a “bad” politician—one who values social welfare and the utility of the SIG directly—may choose the inefficient transfer (a one-off project that favors the SIG) instead of a lump-sum transfer. That politician may be elected if there is asymmetric information relative to the voters about the social value of the project and the aims of politicians. Their model has the advantage of being fully specified in terms of the policy choice. However, testing its predictions is difficult for another reason. As Coate and Morris themselves note, the requirements that the project be socially beneficial in some states of nature and that voters have imperfect information about its effect (ex-ante and ex-post) imply that their model is best suited to explain public projects rather than tariffs, subsidies, etc (p. 1228). So when testing their model one would need to (a) find systematic data on such projects and (b) determine if they were efficient. But if one is indeed able to determine that efficiency ex-post with any certainty then the model would predict inefficient redistribution would *not* be used. Our model on the other hand does apply to policies such as subsidies, tariffs and NTBs whose relative

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<sup>4</sup> Moreover, in our model governments prefer the inefficient policies because they improve its bargaining position relative to SIGs, which is quite distinct from the “sand in the wheels” argument. In fact, in our model, the decrease in bargaining surplus from using the inefficient policy is costly for the government, so such policies are used in spite of acting like “sand in the wheels” not because of it.

<sup>5</sup> Other papers, such as Grossman and Helpman (1994) and Dixit, Grossman, and Helpman (1997), do not focus on the choice of redistribution policy, but they do provide an argument as to why competition among SIGs for government transfers can imply that more distortionary instruments improve the outcome for SIGs. However, they do not model the first-stage policy choice either. They also differ from our paper in other important ways. Competition among lobbies is not present in our model, so in our setting the SIGs generally prefer efficient policies whereas the government may prefer the opposite. Another key distinction is that two basic modeling assumptions in those papers—transferable utility and no government bargaining power—actually imply that inefficient policies would *not* be adopted in our setting.

efficiency is easier to determine and where the ability to do so has no effect on the results since we do not rely on asymmetric information.

As we note in the Introduction we build on Drazen and Limão (2008). The key theoretical difference is that in this paper we model tariffs and NTBs whereas they focus on a lump-sum transfer and a production subsidy. Moreover, we analyze trade agreements as the policy choice mechanism with a view to empirical implementation. The single most important contribution relative to their work is that we derive and test several predictions.<sup>6</sup>

The work on this topic remains largely theoretical. The exception is Ederington and Minier (2006), who examine the determinants of tariffs as a share of tariff plus production subsidy protection for a panel of countries. They mostly find support for the revenue generation hypothesis, i.e. that because tariffs generate revenue they may be preferred to the typically more efficient production subsidies. The authors note in the conclusion the difficulty in testing some theories since (at that time) “none of the theoretical models proposed a fully specified equation for the proper ratio of tariffs to other policy instruments”. Therefore, their approach is to test broad implications from these models using aggregate data, which implies according to them that “none of the results should be interpreted as an outright rejection of any model.” Our approach tackles these issues by specifically deriving such equations from a fully specified model and testing them using detailed product data.<sup>7</sup>

## **2.2 Small Countries and the Value of Trade Agreements**

There is a long standing view that trade agreements are valuable because they provide governments with a commitment mechanism to better withstand or mitigate import competing pressures.<sup>8</sup> Somewhat surprisingly, this view has been formalized almost exclusively by appealing to specific time-inconsistency problems related to some form of investment. Staiger and Tabellini (1987) consider a model in which commitment to free trade helps avoid a time-consistent equilibrium where labor reallocation after an adverse terms-of-trade shock is reduced as people anticipate protection and the government fulfills those expectations with socially excessive protection levels.

Maggi and Rodriguez-Clare (1998) extend Grossman and Helpman (1994) by allowing capital to be mobile in the long run. They show that the government may benefit from committing to free trade

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<sup>6</sup> Another broad argument that has been explored for the use of inefficient transfers is that they can give political benefits to the government or SIG that lump-sum transfers do not (c.f. Weingast, Shepsle, and Johnsen, 1981; Baron, 1991; Dixit and Londregan, 1995, 1996; Acemoglu and Robinson, 2001).

<sup>7</sup> Chandra (2007) studies the relationship between subsidy rules and tariffs and finds that China’s tariff reductions upon entering the WTO were smaller in products where it was most likely to face retaliation if it used subsidies.

<sup>8</sup> The other main argument is that trade agreements allow countries with market power to reduce tariffs in a reciprocal way and internalizes terms-of-trade effects (Bagwell and Staiger, 1999). Maggi and Rodriguez-Clare (2007) combine the commitment motive explored in their 1998 paper with the terms-of-trade motive.

to avoid a distortion associated with the allocation of resources for which it may not receive compensation by the lobbies.<sup>9</sup>

The strategic interaction between international and domestic policy negotiations has long been known (c.f. Putnam, 1988). Similarly to the papers described above we also exploit the strategic interaction due to a government's ability to commit via trade agreements. But there are several key differences. First, the source of the gain from such commitment in our model is a government's improvement in its bargaining position relative to the lobbies rather than a standard time inconsistency problem. The underlying bargaining mechanism we exploit is thought to be important in negotiations.<sup>10</sup> Second, none of the papers above models the *choice* of policy and, with the exception of Staiger and Tabellini (1987), they do not even consider the possibility of alternative policies. This is important because no international agreement allows commitment in all policies, so to evaluate the value of such agreements we need to move away from partial political equilibrium models. Finally, all the papers above focus on the theoretical commitment value of agreements whereas we also provide evidence.<sup>11</sup>

### **2.3 The Relative Efficiency of Tariffs vs. Non-Tariff Barriers**

In the setting we focus on—a small competitive economy with no uncertainty—a tariff is generally at least as efficient as an NTB that leads to the same traded quantities. However, some theoretical papers in trade provide counter examples where NTBs can be more efficient, economically or politically.

For example, the losses from some NTBs may be less transparent than those of a tariff (cf. Hillman, 1989) which in turn may be less transparent than a production subsidy (Magee, Brock, and Young, 1989). This simply applies the disguised transfer idea to these policies and is thus subject to the same comments as above. Moreover, as Falvey and Lloyd (1991, p. 463) argue, the importance of the transparency motives has decreased over time, as estimates of the costs of protection have become more available. Information asymmetries are not needed in our model.

Most papers on this topic examine the relative efficiency of tariffs vs. a specific type of NTB: quotas; and provide a motive for which the quota's ability to control quantities becomes an advantage. In Kaempfer et al. (1989) this advantage is driven by the existence of a domestic monopoly. Others

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<sup>9</sup> Mitra (2002) modifies Maggi and Rodriguez-Clare's framework by removing capital mobility and introducing fixed costs of political organization.

<sup>10</sup> Schelling (1960) states that "The power of a negotiator often rests on a manifest inability to make concessions and meet demands." He goes on to argue this is an advantage that domestic constraints can bring in an international negotiation but clearly, the effect can also run in the opposite direction.

<sup>11</sup> Staiger and Tabellini (1999) provide some indirect evidence that GATT rules helped the U.S. in making domestic trade policy commitments. The value of that commitment is driven by production distortions but unlike Staiger and Tabellini (1987) they do not consider production subsidies.

have focused on the role of uncertainty about world prices under risk aversion (c.f. Young, 1980; Young and Anderson, 1982; Hillman, 1989).<sup>12</sup>

We do not dispute that there are instances when the ability to precisely control quantities generates an advantage of quotas over tariffs. We doubt that this reversal of efficiency is the norm for most goods and if it were we should not find empirical support for our model. Moreover, since the Uruguay Round many quantitative restrictions were outlawed and NTBs now often take other forms such as product and technical standards and various forms of import charges (Michalopoulos, 1999).<sup>13</sup> Thus, we model an NTB that can capture not only the effects of a quota but more generally of a measure that generates a wedge between domestic and world prices. More importantly, our model also has the advantage that it can explain why tariffs instead of even more efficient measures (e.g. production subsidies) will be used for redistribution and how the choice across different policies occurs. Ultimately, whether applied NTBs are on average less efficient than tariffs is an empirical question and our model will provide us with an estimation equation that allows us to answer it.

### 3 THEORY

#### 3.1 Setup

We consider a small competitive economy that takes world prices as given. Each individual's factor endowments may differ but they have identical preferences described by

$$u = x_0 + \sum_{i=1}^n u_i(x_i)$$

where  $x_0$  is consumption of the numeraire good;  $x_i$  denotes consumption of good  $i$  and the sub-utility functions  $u_i(\cdot)$  are differentiable, increasing and strictly concave. An individual with income  $E$  consumes  $x_i = d_i(p_i) = [u'_i(p_i)]^{-1}$  of each  $i$ , and  $x_0 = E - \sum_i p_i d_i(p_i)$  of the numeraire. The indirect utility is thus given by  $v(\mathbf{p}, E) = E + s(\mathbf{p})$ , where  $\mathbf{p}$  is the vector of domestic prices, and the consumer surplus derived from the non-numeraire goods is given by  $s(\mathbf{p}) = \sum_i u_i(d_i(p_i)) - \sum_i p_i d_i(p_i)$ .

The numeraire is produced using labor with a marginal product equal to one. Assuming a sufficiently large labor supply ensures that in equilibrium this good is always produced and the wage equals unity. Each of the non-numeraire goods is produced using labor and a sector-specific factor,

<sup>12</sup> Falvey and Lloyd (1991) focus on the relative efficiency of quotas and tariffs under domestic demand vs. supply shocks.

<sup>13</sup> While determining the relative efficiency of each type of NTB at each point in time relative to tariffs is nearly impossible, we now have evidence that the ones imposed are highly trade restrictive in a large set of countries. Using data and estimates from Kee et al (2006) we find that the overall trade restrictiveness index for the typical country is equivalent to a uniform tariff of 14% if we ignore NTBs, but it jumps to 27% when NTBs are included. Moreover, for about 35 countries that index doubles when NTBs are included.

with constant returns to scale. The supply of the specific factors is fixed. Since the wage is constant, we can denote the return to the specific factors as  $\Pi_i(p_i)$  — a function of domestic prices. By Hotelling’s lemma, output is then given by  $y_i = \Pi'_i(p_i)$ .

The government has tariffs and NTBs at its disposal.<sup>14</sup> For concreteness, we consider NTBs that generate a wedge between the domestic and foreign price, as a tariff does, and can also generate rents. We model NTBs as less efficient than tariffs in a single dimension: a fraction  $\phi$  of those rents is dissipated whereas in the tariff case they are available in the form of tariff revenues that can be consumed in the importing country. By allowing  $\phi$  to range between zero and one we can capture different degrees of the inefficiency in a simple but clear way.<sup>15</sup>

In sum, the two key features required to characterize the NTB in the model are its inefficiency relative to the tariff and its impact on the domestic price, i.e. the NTB’s *advalorem* tariff equivalent. The per capita rents from using an NTB with *advalorem* equivalent of  $\tau$  and a tariff  $t$  is then given by

$$r(\mathbf{p}) = \sum_i \left[ t_i p_i^* + (1 - \phi) \tau_i p_i^* \right] [d_i(p_i) - y_i(p_i) / N]$$

where  $p_i^*$  is the world price and  $t_i p_i^*$  measures the increase in the domestic price due to the tariff whereas  $\tau_i p_i^*$  is the equivalent wedge due to the NTB. The second term in brackets represents import quantity ( $N$  measures the total population). All the tariff rents (i.e., its revenue) are available for domestic consumption, but for the NTB that is the case for only a fraction  $1 - \phi \in [0, 1]$ . We make the standard assumption that the government rebates *these* rents uniformly to all individuals but the results would be similar if the government consumed them directly.

The policies also generate rents for the set of sectors,  $L$ , where the specific factors organize into SIGs that lobby the government. The joint gross welfare of lobby  $i$  is:

$$W_i = \Pi_i(p_i) + \alpha_i N [1 + r(\mathbf{p}) + s(\mathbf{p})]$$

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<sup>14</sup> This policy set is determined by the data available to test the model in the empirical section. We could have instead included production subsidies and tariffs and the same mechanism we explore would imply that the government would gain by restricting subsidies and using tariffs. Alternatively, if we allowed subsidies, tariffs and NTBs we conjecture that the qualitative results would be similar to the ones we obtain as long as governments had a commitment technology to constrain subsidies and tariffs as occurs in the WTO.

<sup>15</sup> A specific example of such NTBs are quantitative restrictions where some of the licenses are given to foreigners or to residents that must “burn” resources in some rent seeking process. If there is revenue-seeking behavior then we can reinterpret  $\phi$  as the *differential* amount that is wasted in NTBs relative to tariffs. It is reasonable to consider  $\phi > 0$  given that NTBs tend to generate lumpy amounts of rents that can be discretely allocated. For additional arguments and evidence on the relative inefficiency of quotas see Anderson (1988). This does not imply that the model captures all the different types of NTBs, which would be impossible. As discussed in the literature review, certain NTBs have the same effects as tariffs in some economic environments but not in others. Nonetheless, the key insight of the model should apply to various NTBs as long as they generate a wedge relative to the world price and are less efficient than the tariff in maximizing the political surplus, as defined below.

where  $\alpha_i$  is the fraction of the population that owns some of the specific factor in this industry and the terms in brackets are respectively those owners' wage, rebated rents, and consumer surplus. We analyze the case of highly concentrated factor ownership,  $\alpha_i \rightarrow 0$ , so each industry lobbies only for its own product. This allows us to focus on the interaction between the government and each SIG and abstract from lobby competition. Each SIG offers the government a “lobby good”, represented by  $C_i$  and described below, in order to obtain an increase in the level of protection it receives. Thus, we denote the net welfare of the members of lobby  $i$  by  $V_i = W_i - C_i$ .

The government maximizes a weighted sum of lobby goods and social welfare:

$$G = \sum_{i \in L} \Psi_i(C_i) + aW(\mathbf{p}), \quad a \geq 0 \quad (1)$$

where social welfare is given by the sum of indirect utilities over all individuals, which includes wage and specific factor income plus net taxes (or rents) from policy and consumer surplus:

$$W(\mathbf{p}) = N + \sum_{i=1}^n \Pi_i(p_i) + N[r(\mathbf{p}) + s(\mathbf{p})] .$$

Several models of SIGs, e.g. Grossman and Helpman (1994), assume that the lobby good is equally valued by the government and the lobby, i.e. that  $\Psi_i$  is linear and thus utility is transferable. This is a useful simplifying assumption that may be reasonable when that lobby good is cash contributions and there are no limits on them. However, in several countries— including the one we analyze in the empirical section—there are strict constraints on such contributions. Thus, SIGs can and do resort to other goods and services, which are not necessarily perfect substitutes. Moreover, as Drazen and Limão (2008) argue, politicians may have diminishing marginal utility for lobby goods such as getting out the vote in a district where a lobby's membership is concentrated; providing information about an issue; lending jets for campaigning or vacationing; etc. In sum, we think it is reasonable to assume, as we do, that  $\Psi_i$  is strictly concave. The resulting non-transferability of utility between government and lobbies will be key in generating the use of inefficient policies. Alternatively, we could model non-transferability by allowing  $C$  to enter linearly in  $G$  but require it to be produced by each lobby using the numeraire as the input into a diminishing returns production process.

There are two stages in the game. In the first, the government decides whether to commit to policy constraints via an international agreement. In the second stage, the government (Nash) bargains with each SIG over the level of lobby goods,  $C$ , and policies,  $(t, \tau)$ . We derive the subgame perfect Nash equilibrium for  $C$ ,  $t$  and  $\tau$  for given policy constraints and then which first stage constraints emerge.

### 3.2 Absence of Commitment and the Use of the Most Efficient Available Policy

We first show that, in the absence of policy constraints, the most efficient available policy is the only one used in equilibrium. This is a useful baseline for two reasons. First, it starkly illustrates the importance of having access to a commitment technology to generate inefficient policies. Second, as we subsequently show, the government does not always choose constraints even if it has access to a commitment technology; the policy values derived below also apply to that case.<sup>16</sup>

Intuitively, why should we observe only the tariff policy in the absence of constraints? It is obvious that in our setup a tariff is more efficient than the NTB from a *social welfare* perspective since under the NTB a fraction of the rebated rents are dissipated. But the relevant definition of efficiency in the context of the policy choice puzzle is *political* efficiency, i.e. which policy maximizes the joint payoff to the government and lobby for any given level of the lobby good. In our model the two inefficiency definitions (social and political) exactly match, since the government objective is a weighted value of social welfare and lobby goods. Therefore, for a given level of imports and contributions, the lobby payoff,  $V$  is identical under  $t$  or  $\tau$ , but the government payoff is lower under  $\tau$ . So  $t$  is both socially and politically more efficient in this setup. This implies that in equilibrium it is costlier for the lobby to compensate the government for an increase in  $\tau$  that leads to the same change in imports as an equivalent change in  $t$ , and thus only the latter is used.

To analyze the specific case of no commitment we employ the general Nash bargaining problem solved in the second stage but assume the first-stage tariff constraint is absent or not binding. In the following section we relax this. Formally, we write the maximization as follows:

$$\max_{t, \tau, C} U = (G(t, \tau, C) - G^0)^\gamma (V(t, \tau, C) - V^0)^{1-\gamma} \quad \text{s.t. } t \leq t^c; G \geq G^0; V \geq V^0 \quad (2)$$

Letting  $\lambda$  be the multiplier associated with the tariff constraint, the first order conditions for  $t$ ,  $\tau$  and  $C$  when  $V > V^0$ ,  $G > G^0$  are given respectively by:

$$\frac{\gamma}{G - G^0} G_t + \frac{1-\gamma}{V - V^0} V_t - \lambda = 0 \quad (3)$$

$$\frac{\gamma}{G - G^0} G_\tau + \frac{1-\gamma}{V - V^0} V_\tau \leq 0 \quad (4)$$

$$\frac{\gamma}{G - G^0} G_C + \frac{1-\gamma}{V - V^0} V_C = 0 \quad (5)$$

$$t^c - t \geq 0 \quad (6)$$

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<sup>16</sup> In our empirical work the goods where such constraints are absent will be used as the counterfactual to test the model's prediction that constraints on a policy lead to the use of relatively less efficient ones.

and the (omitted) corresponding complementary slackness conditions for (4) and (6); here a subscript denotes a partial derivative. To ensure an interior solution we assume throughout that  $\Psi'(0) \rightarrow \infty$ .

If the tariff cap is absent or not binding then  $\lambda$  equals 0 and from (3) and (5) we obtain:

$$\frac{G_t}{G_c} = \frac{V_t}{V_c} \Leftrightarrow \frac{at_i(p_i^*)^2 m'_i}{\Psi'_i(C_i)} = \frac{y_i(p_i)p_i^*}{-1} \quad (7)$$

Subsequently, we will determine the optimal constraint and whether it binds relative to the unconstrained, so it is useful to derive the (implicit) value of the unconstrained tariff from (7) as:

$$t_i^u = \frac{y_i(p_i)}{-ap_i^* m'_i(p_i)} \Psi'_i(C_i) \quad (8)$$

Thus, organized industries receive tariff protection. Note that if  $C$  entered the government's objective linearly then this expression is similar to the well-known expression obtained by Grossman and Helpman (1994) for an organized industry when factor ownership is concentrated.

To see that only the tariff is used we need only show that  $\tau = 0$ . This occurs if (4) is negative, which must hold whenever  $\lambda = 0$  and (3) holds with equality, i.e. whenever there is an unconstrained positive tariff. This is straightforward to show because  $V_\tau = V_t$ —both policies have a similar effect on the domestic price and thus profit—and  $G_\tau < G_t$ —since the NTB generates fewer rents than the tariff.

### 3.3 Commitment Tariff Caps in the Absence of NTBs

We now allow government access to commitment so it can *choose* whether it prefers to set a maximum cap on the tariff prior to negotiating with each SIG. To clearly illustrate the government's incentive to do so we first assume that no other redistribution policies can be used. In the next section we show the government's incentive is still present when less efficient policies are available.

The government sets the cap,  $t^c$ , in the first stage by maximizing its objective, in (1), taking into account the effect on the equilibrium tariff and contributions, which are found by solving the Nash problem previously defined but with  $\tau = 0$  as an additional constraint. The first order condition for  $t^c$  is

$$\Psi'_i(C_i) \frac{\partial C_i}{\partial t_i} + a \frac{\partial W}{\partial t_i} = 0 \quad (9)$$

which we solve to obtain

$$t_i^c = \frac{\partial C_i / \partial t_i}{-a(p_i^*)^2 m'_i} \Psi'_i(C_i) \quad (10)$$

If  $t_i^c \geq t_i^u$  then the constraint does not bind; otherwise it binds and this would prove the government's benefit from constraining tariffs ex-ante. Given the independence of irrelevant alternatives in Nash bargaining, the government would actually be indifferent between  $t_i^c = t_i^u$  and any

higher constraint, so we can focus on determining if (10) is equal to (8) or lower. Omitting the product subscripts the condition for a non-binding constrain is

$$\frac{\partial C/\partial t}{-a(p^*)^2 m'(t^c)} \Psi'(C(t^c)) = \frac{y(t^u)}{-ap^* m'(t^u)} \Psi'(C(t^u))$$

If  $t_i^c = t_i^u$  then the equilibrium values of  $C, p$ , and thus  $y$  and  $m'$  would be identical in (8) and (10).

Replacing these above we should then obtain  $\partial C/\partial t = \partial \Pi/\partial t$ .

In the Theory Appendix we derive  $\partial C/\partial t$  by implicitly differentiating (5) and show that the equality above holds if and only if either (a) the government has all the bargaining power or (b) lobby goods are valued linearly so utility would be transferable. If the government does not have all the bargaining power and lobby goods have diminishing marginal utility, then  $\partial C/\partial t < \partial \Pi/\partial t$ , i.e. we have a contradiction that shows the government prefers a constraint. The intuition is the following: if the constraint binds then instead of the equality above we have  $\partial(\Pi - C)/\partial t > 0$ , which means that relaxing the constraint, i.e. increasing the tariff, would increase the payoff to lobbies with no first order cost to the government (since it is optimally setting  $t$ ). The resulting increase in joint surplus could be collected via the bargaining in the second stage if the government has all the bargaining power. Alternatively, it would also be collected if contributions enter linearly so that they are used to share the joint surplus. But if contributions have diminishing marginal utility and the government cannot obtain the entire joint surplus then the increase in *joint* surplus from relaxing the cap is offset by a smaller government share of it. This decrease in the share is due to the deterioration in the government's political terms-of-trade. In other words, a binding cap improves the government's bargaining position thus generating a benefit for it that offsets the loss due to the decrease in joint surplus.

One point to note in the preceding analysis is that the government is able to extract contributions from the lobby under a tariff cap even in the absence of NTBs as long as it can credibly threaten to set a zero tariff. This is certainly the case with WTO commitments since they are defined as a maximum tariff so the analysis applies directly to this case. However, in the case of the customs union the government threat of a zero tariff is less credible since the customs union partner may not allow it to fulfill it. In practice, customs unions probably allow some flexibility for members to threaten to deviate down from the exact external tariff. However, in the extreme case where they do not the only threat governments can use in bargaining with SIGs is the cap itself in which case the government can only extract contributions if additional unconstrained policies are available, as we now analyze.

### 3.4 Commitment and the Co-existence of Efficient and Inefficient Policies

In section 3.2 we showed that in the absence of a commitment technology only the relatively efficient policy would be used and that commitment generates a benefit for the government. Thus we may expect constraints on those policies to be the first ones to be pursued in agreements. But SIGs are notoriously creative in finding alternative redistribution policies and the government is not able to constrain all of them.<sup>17</sup> Therefore, we now show how constraints on tariffs lead to the emergence of less efficient policies. We first take these constraints as given, as they would be in the second stage, and derive their impact on NTBs. This is one of the relationships we estimate in the empirical section.

Let us first explain how tariff caps,  $\bar{\tau}^c$ , can lead to NTB use in the second stage. Clearly if that cap is equal to zero and the NTB were also set to zero there would be gains from trade between the lobby and government. This occurs since when  $t=\tau=0$  the lobby offers  $C=0$  and the marginal benefit of increasing  $C$  is sufficiently large to the government— as is simple to verify using (4) and (5). Given the large gains from political trading at  $t = \tau = 0$ , it is also straightforward to show that an NTB will also be used for some strictly positive cap level. However, as the cap increases the NTB value must eventually decline since, as we have shown earlier, when  $\bar{\tau}^c = t^u$  we have  $\tau = 0$ . So our model predicts that:

- (1) a good with a sufficiently low tariff cap implies an NTB will be used and
- (2) the likelihood and the value of the NTB are eventually decreasing in the value of that cap, or more precisely the difference between that cap and the unconstrained tariff value.

Alternative models could predict similar relationships between tariffs and NTBs in *all* goods. One specific feature of our model, and one we will test, is that it predicts these relationships only in goods where a binding tariff cap exists. Before generating any additional predictions, we derive the NTB level for a given binding tariff to show the results mentioned above.

The interior NTB solution when there is a binding cap requires the marginal rate of the substitution across policies for the government to be equal to the lobbies, as we can see from solving (4) and (5) to obtain:

$$\frac{G_\tau}{G_c} = \frac{V_\tau}{V_c} \quad \Leftrightarrow \quad \frac{a \left[ \left( \tau_i (1 - \phi) + \bar{\tau}_i^c \right) (p_i^*)^2 m_i' - \phi p_i^* m_i \right]}{\Psi_i'(C)} = \frac{y_i(p_i) p_i^*}{-1} \quad (11) \quad ,$$

which we can re-arrange to obtain

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<sup>17</sup> One reason for this is that defining, negotiating and enforcing such constraints on every potential policy is very costly. These costs can explain why agreements such as the WTO remain highly incomplete contracts. We take the availability of commitment technology across policies as given but conjecture that the model can be extended to predict that the governments would optimally choose to first commit in the most efficient policies if there is some fixed cost to committing.

$$\tau_i^c = \frac{1}{1-\phi} \left[ \frac{y_i(p_i)}{-ap_i^* m_i'} \Psi'(C_i) - \bar{t}_i^c \right] - \frac{\phi}{1-\phi} \frac{1}{\varepsilon_i} \quad (12)$$

where  $\varepsilon_i = -m_i'(p_i)(p_i^*/m_i(p_i))$  is a measure of the absolute value of import demand elasticity. We immediately see that if the tariff constraint was zero and the NTB was almost as efficient as the tariff, i.e.  $\phi \rightarrow 0$ , then the NTB level would equal the first term in the brackets, which is exactly the unconstrained tariff level in (8),  $t^u$ . More generally, the NTB level is increasing in the gap between the “unconstrained level” and the cap. This is one of the central predictions we will test.<sup>18</sup>

### 3.5 Commitment Decision

We now derive which goods the government chooses to commit in and, when possible, the level of that commitment. We also discuss the impact of allowing SIGs to *directly* influence those commitments.

The government commitment decision in the first period can be modeled in two alternative ways. First, allow it to choose whether or not to commit to an exogenously given cap. Second, allow it to choose both whether to commit and the optimal level of the cap that maximizes its objective in the first stage. Clearly the conditions for the first alternative are more stringent since the government cannot optimally choose the cap.

It is important to show the result for the first alternative—commitment to an exogenous cap—since it may be the only available one. One example is when a country must adopt another’s common external tariff and it can at most decide if a given good is subject to an exogenous cap level. Another example is if the government has *some* influence over the cap level but is unable to choose it to exactly maximize its objective as we represented it (e.g. if there are other constraints unobservable to us). Thus, we first derive sufficient conditions such that a government can benefit from a commitment to a cap even if it is not necessarily able to set its level optimally.

In the first stage, the government chooses to commit to an exogenously *given* cap in a product  $i$  if its payoff evaluated at the constrained equilibrium exceeds the unconstrained:<sup>19</sup>

$$G(\bar{t}_i^c, \tau_i^c(\bar{t}_i^c, \gamma_i), C_i^c(\bar{t}_i^c, \gamma_i), \cdot) \geq G(t_i^u(\gamma_i), \tau_i^u(\gamma_i), C_i^u(\gamma_i), \cdot) \quad (13)$$

<sup>18</sup> Note that when  $t^c$  and  $\phi$  are positive the equilibrium *value* of the expression that captures the “unconstrained level” motives is different from the equilibrium value of  $t^u$  in (8). Moreover, the equilibrium value of the NTB can differ for a given positive commitment level  $t^c$  in the WTO vs. a customs union since in the latter the government generally cannot threaten to set the tariff below the commitment. Thus in a good bound under the customs union the government will typically collect fewer (or no) contributions for the tariff although it will still be able to collect them for NTBs, which it can always threaten to set to zero.

<sup>19</sup> Given the separability of  $G$  over goods, we can treat the choice over *each* good  $i$  independently of the values for other goods. If the government had to choose between entering an agreement with an exogenously given set of caps on a *set* of goods and could not opt out of any given one then we would need to consider the aggregate effect and (13) would not necessarily have to hold for each  $i$ . In the WTO and in some PTAs the government has some discretion to opt out, which is why we focus on this formulation.

The NTB and contribution values under the tariff constraint are the equilibrium ones determined in the second stage, as explained in the previous section. The unconstrained values are the ones determined in section 3.2, which implied  $\tau^u(\gamma) = 0$ . If (13) holds then the government chooses to commit even if it cannot choose the optimal cap, thus it would also want to commit if it could choose the value of  $\bar{t}^c$  that maximizes the left-hand side of (13). This means that a sufficient condition for (13) to hold is also sufficient to ensure that a government commits to an optimal cap level of its choosing.

We illustrate the result graphically in Figure 1, which depicts payoffs in G-V space. The bold line represents the Pareto frontier in the absence of commitment. It yields a higher *joint* payoff than the alternative where the tariff is constrained, which we have seen in the previous section implies the less efficient NTB is used. Note first that for a large enough bargaining power (13) never holds, that is the government always chooses *not* to commit to a cap. This is obvious for  $\gamma = 1$ , since then the government obtains the entire surplus and never wants it reduced. It is also simple to illustrate that the same is true for other sufficiently high  $\gamma$  that are still lower than 1. When the cap is sufficiently low the maximum *possible* government payoff is strictly lower than with no constraint. We can thus define  $\gamma^h$  as the level at which  $G^u(\gamma = \gamma^h) = G^{cM}(\gamma = \gamma^h)$ , as shown in figure 1. Therefore, governments with sufficiently high bargaining power do not commit to a stringent cap. This is true even though we focus on a case where the commitment does not worsen the government's threat point.<sup>20</sup>

Governments with no bargaining power are indifferent between policies. When  $\gamma$  is zero, equation (13) must hold with equality since the government obtains its reservation payoff, which is the free trade equilibrium in good  $i$  and thus it is identical with or without commitment. Therefore, (13) holds with a strict inequality if as we increase  $\gamma$  from zero the government payoff increases faster under commitment than in its absence. When this is the case the government has a strictly higher payoff under commitment for some  $\gamma \in (0, \gamma^*)$ , where  $\gamma^*$  is defined as the lowest positive  $\gamma$  at which (13) holds with equality. More formally, the sufficient condition for this is

$$\lim_{\gamma_i \rightarrow 0} \frac{d}{d\gamma_i} G(\bar{t}_i^c, \tau_i^c(\bar{t}_i^c, \gamma_i), C_i^c(\bar{t}_i^c, \gamma_i), \cdot) > \lim_{\gamma_i \rightarrow 0} \frac{d}{d\gamma_i} G(t_i^u(\gamma_i), \tau_i^u(\gamma_i), C_i^u(\gamma_i), \cdot) \quad (14)$$

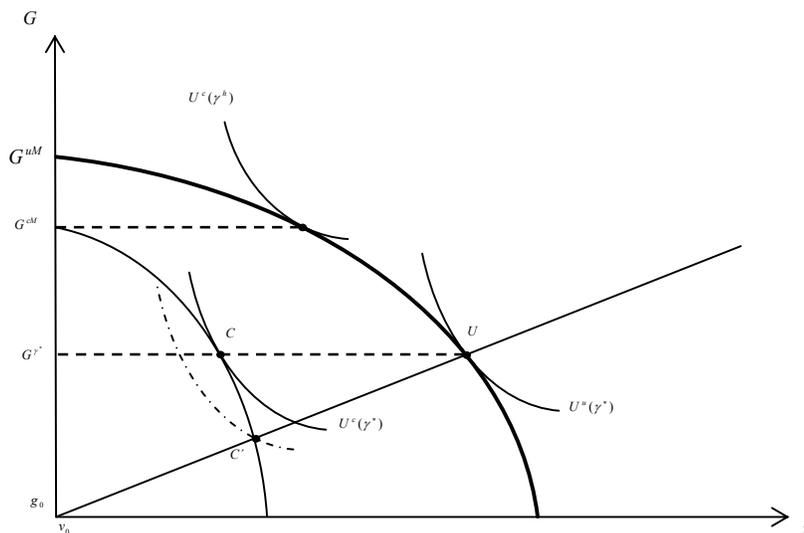
This condition can be simplified and interpreted in an intuitive way that in our context requires the improvement in the government's bargaining position from committing to a tariff cap to exceed the

<sup>20</sup> As we noted before the threat point of zero tariffs is credible after a commitment to a tariff in the WTO since it is implemented as a maximum. In the case of the customs union the threat point may no longer be a zero tariff in which case there is an additional cost to the government from committing. On the other hand the customs union has an additional unmodelled benefit: Turkish exporters receive higher prices by selling in the protected EU market. Since the Turkish government had little choice over the binding tariffs in the EU we do not analyze this choice in the empirical work and thus do not extend the theoretical model to include it here either.

loss arising from the reduction in bargaining surplus due to the constraint and subsequent use of the NTB. Drazen and Limão (2008) show this for a different set of policies and note that this condition need not always hold and must be checked in each policy setting. Thus in the Appendix we provide a numerical simulation showing this condition holds in our model if the cap is not too stringent relative to the unconstrained value. Very stringent caps make the *sufficient* condition less likely to hold because they destroy too much surplus, which cannot be offset by the government’s increased share in it.

Figure 1 illustrates the role of bargaining power in the government’s decision to commit. Consider a  $\gamma \in (0, \gamma^*)$  so that point  $U$  is the solution under no commitment. The slope of the Pareto frontier reflects the rate at which government’s payoffs can be traded for those of the lobby. The steeper it is, the more costly a given increase in  $V$  is and thus it becomes more efficient (in terms of the Nash product being maximized) to increase the government *share* of the payoffs. To see this consider the ray from the origin that maintains the same ratio of payoffs at  $C'$  as at  $U$ . The dotted Nash iso-value line at  $C'$  has the same slope as  $U^U$  at  $U$  (since the Nash product is log linear) indicating an unchanged marginal rate of substitution of payoffs. But the Pareto frontier under commitment is steeper due to the inefficiency of the NTB and the fact that the government has diminishing utility for lobby goods. Thus the equilibrium under commitment entails a value of  $G$  above  $C'$ , which at the critical value  $\gamma^*$  is equal to the unconstrained. For lower  $\gamma$  the government payoff is higher when it commits to a constraint.

**Figure 1: Impact of Policy Constraints on Payoffs**



In sum, the model predicts that a government is less likely to commit to a cap in products where its bargaining power is higher. If the government prefers to commit to an exogenous cap for some  $\gamma \in (0, \gamma^*)$  then it also prefers to do so if it can optimally choose the cap *level*. Moreover, if  $\gamma$  is sufficiently high then it chooses not to commit even if it can optimally choose the cap level since, in the limit, when it has all the bargaining power any commitment constrains the overall surplus it receives.

When we examine the data, we will consider the role of bargaining power in determining if the government constrains the tariff in a given good. However, from that data alone it is not always obvious that the constraint will bind. In fact, in the absence of any other cost from committing, the government could always choose to commit to a tariff constraint for any bargaining power if that constraint was not binding. Thus bargaining power may not affect the choice of goods a government binds, particularly if the government has some influence on the cap level. But in that case we can explore a related prediction: a positive relationship between bargaining power and the cap to unconstrained tariff difference. As noted before, when  $\gamma < \gamma^*$ , equation (13) holds strictly for an exogenous cap and thus it must also hold if that cap is optimally chosen. Therefore  $t^c(\gamma) - t^u(\gamma)$  is negative for at least some  $\gamma < \gamma^*$  but it must be non-negative for sufficiently large  $\gamma$ .

To sharpen the model's predictions we have thus far assumed that SIGs have a negligible ability to influence the first stage constraints. This absence of ex-ante lobbying is also used by others in the context of trade agreements, c.f. Maggi and Rodriguez-Clare (1998), and it would be satisfied for example in industries that are expected to organize but have not yet done so at the commitment stage (so they cannot lobby against constraints). It may also be a reasonable assumption for organized industries provided that the government is somewhat insulated from their pressure during the international negotiation stage. It is also important to note that we can relax this simplifying assumption. For example, we can show that policy constraints can emerge in equilibrium even if we allow the government and SIG to bargain over them during the first stage (this would occur provided the government has higher bargaining power during the first stage than the second).

If we assumed instead that the import SIGs have full control over any tariff constraints via international agreements then the model would predict that tariff commitments would never take place. Ultimately, whether such commitments occur and are affected by bargaining power is not a theoretical question but an empirical one, which we address in section 4.

### 3.6 Social Welfare Value of Commitment

Before testing any predictions, we clarify a key normative implication of the model. The government joins an agreement if it improves its objective in (1) so, as shown, the agreement provides a *political* commitment value. We now ask if there is also a social welfare value of commitment.

A necessary condition for social welfare to increase with commitment is for total protection to fall. In the absence of NTBs, this reduction is both necessary *and* sufficient; so in this case the agreement has both a political *and* a social welfare commitment value since the new protection level is simply  $t^c < t^u$ , as shown in section 3.3. The question is more interesting when we allow for NTBs to substitute for the constrained tariffs. We must now determine if total protection falls and does so by enough to offset the inefficiency of the NTB.

Total protection under commitment is  $\tau + t^c$ , for a given  $t^c < t^u$ . If  $\phi = 0$  then the NTB is as efficient as the tariff and thus a perfect substitute for it, which implies that total protection would be unchanged, i.e.  $\tau + t^c = t^u$ . Therefore, if an increase in  $\phi$  reduces  $\tau$  then total protection will be lower under commitment. We could verify this by performing the comparative static of increasing  $\phi$  using the FOC in (4) and (5) at a given  $t^c$ . Alternatively, we can illustrate not just the sign but the impact of inefficiency on the equilibrium percent change in total protection,  $(\tau + t^c - t^u) / t^u$ . We do this in figure 2, which employs the parameterized model in the appendix that satisfies the sufficient condition for the government to commit. When  $\phi = 0$  we confirm there is full substitution and so no change in total protection. More inefficient NTBs lead to lower protection, e.g. commitment causes total protection to fall by more than 5% if  $\phi = 0.3$ , an inefficiency value close to our subsequent empirical estimate. The exact magnitudes depend on other parameter values but the main point is that it is simple to find cases where the government would choose to commit and total protection falls by a non-trivial amount.

Even if total protection falls, a part of it is now done via a less efficient policy, which generates fewer rents. If those rents are consumed by the government then social welfare, as measured by the sum of producer and consumer surplus, would still increase under the lower levels of protection achieved by commitment. However, if the rents are rebated to the citizens then we need to factor in this change, which may be negative.<sup>21</sup> Despite this ambiguity on the change in rents, we can easily show that if total protection fell sufficiently then the net effect of commitment on social welfare would be positive. Alternatively, we could provide conditions on different parameters that generate a positive net effect. Since this is not our main focus, we simply illustrate the result using the parameterized example.

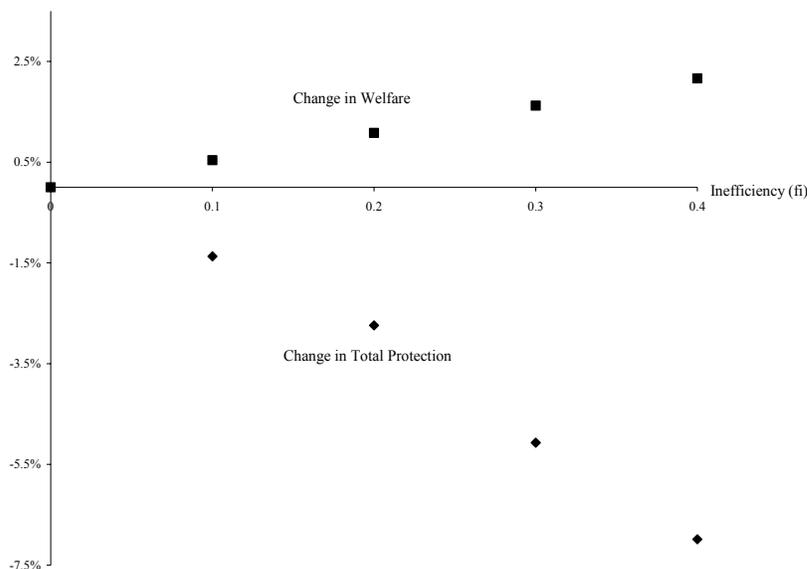
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<sup>21</sup> A sufficient condition for an increase in total rents is for the initial tariff to exceed the tariff revenue maximizing level so that the constrained lower tariff could generate higher revenue and thus total rents even if the NTB generated none.

Figure 2 shows the percent increase in social welfare in an import good where the government chooses to commit. It is increasing in the level of the inefficiency and non-negligible: about 1.5% when  $\phi = 0.3$ .

To summarize, by allowing commitments to restrict tariffs the agreement leads to the use of less efficient policies. This imperfect policy substitution throws “sand-in-the-wheels” of the redistribution process and tends to improve social welfare to the extent that it reduces total protection. Thus in the empirical section we will try to estimate if there is policy substitution and it is imperfect. It is important to understand that the social welfare effect is a positive side benefit rather than a sufficient or even necessary motive for the government to enter such agreements. We can see it is not sufficient since the government chooses not to commit in some cases when commitment can increase social welfare (e.g. if it has all the bargaining power). We can show it is not necessary by noting that the government would choose to commit even if it placed no value on social welfare, e.g. if  $W$  in (1) represented only the policy rents and these were consumed by the government.

**Figure 2: Social Value of Tariff Commitment Agreements under Alternative Inefficient Policies**



- (a) Percent change in total protection is equal to  $(\tau(\phi) + t^c - t^u) / t^u$  where we employ the equilibrium policies in the appendix under which the government sufficient condition for commitment is met.
- (b) Percent change in welfare is  $(W_i^c - W_i^u) / W_i^u$  where  $W_i$  measures welfare under commitment (c) or in its absence (u) as the sum of surplus for consumers, producers and tariff revenue for import  $i$ . See appendix for details.

#### 4 EVIDENCE

We now investigate the specific predictions of the model. First, we examine the impact of tariff constraints on the use of the typically less efficient non-tariff barriers (NTBs). We then estimate the impact of bargaining power on governments’ commitment choices in international trade agreements.

Next, we quantify each of these effects and the impact of bargaining power via tariff commitments on NTBs and provide structural estimates of how inefficient these NTBs are.

#### **4.1 Commitment and the Use of Less Efficient Policies: Data and Empirical Strategy**

We exploit variation in tariff constraints generated by the two most common types of commitment in these policies: those in multilateral and preferential trade agreements. In the WTO countries negotiate tariff bindings, which are ceilings on applied tariffs. If countries set their *applied tariffs* above that binding, they are subject to a dispute from the countries facing those higher tariffs. The cost of such disputes can range from the simple administrative costs of defense, e.g. providing information about why the tariff now exceeds the negotiated binding, to the loss of export market access if the plaintiff country retaliates by increasing its own tariffs.

Thus, in goods with negotiated tariff constraints in the WTO there are additional costs to setting tariffs above a certain level. When those costs are sufficiently high, the government can credibly constrain its maximum tariff and then, according to the model, if that tariff constraint binds there is a higher likelihood of an NTB. Moreover, all else equal, the lower the tariff binding level relative to the unconstrained the higher the NTB *advalorem* equivalent. In sum, we exploit the cross-product variation in tariff binding status and level in the WTO to examine their effect on the use of NTBs.

In PTAs, countries agree to preferential tariffs between themselves and, in certain cases, to set a common external tariff. Non-enforcement of those tariffs can generate retaliation by other PTA members—a cost that provides an additional source of commitment. The retaliation can be particularly costly in some cases, e.g. if Turkey fails to enforce the tariffs specified in its customs union with the EU, it may be denied full EU membership. Moreover, when there is a large asymmetry in the size of members the common external tariff is mostly or fully determined by the existing tariffs of the larger partner. This can generate a large change in tariffs for the smaller partner that is likely to be “exogenous” in the sense that it is independent of other determinants of its trade policy. Turkey for example, had to adopt EU tariffs as they existed, except in some products that were temporarily excluded from that agreement.<sup>22</sup> If the common EU tariff constrains Turkey to lower its own tariffs then the model predicts additional protection via NTBs.

##### *Background information on country selection*

Several of the predictions of the model are better tested by exploring cross product rather than cross-country variation since the latter would likely contain considerable unobserved heterogeneity.

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<sup>22</sup> For details see the WTO’s Trade Policy report for Turkey in 1998.

Given this and the detailed data required for some variables, we focus on a single country. The template of the analysis can subsequently be applied to other countries for which such data is collected. Three important data considerations guided our country choice. First, the availability of NTB data and variation in binding status in the WTO. Since the implementation of the Uruguay Round commitments many developed countries have bound most of their tariff lines. Thus we focus on Turkey, which has bound only about half. Second, the NTB data for this country is available for the year immediately after an important customs union with the EU that led to a substantial cut in Turkey's external tariff. Third, Turkey has strict laws on cash contributions to politicians, which suggests that industries must reward them using "lobby goods". These goods are more likely to be subject to diminishing returns than cash and thus Turkey fits our model better than a country where unlimited cash contributions are possible.<sup>23</sup> Moreover, the theory focuses on a small open economy, which rules out several alternative countries.

Below we discuss the different variables we employ. The data appendix provides more detailed information about their source and construction and Table 1 provides summary statistics.

To place the analysis in context, we note a few basic facts about Turkey's trade policy. Turkey moved away from an import substitution regime in the early 1980's. It implemented a major trade liberalization that reduced tariffs and removed most of its NTBs, such as quotas. Some of the tariffs were replaced by other types of duties in the 1980's, e.g. the mass housing fund, infrastructure tax, which were still taxes on imports. But most of these taxes on imports had also been removed by 1993 (Togan, 1995). Due to this liberalization, by 1994 only about 2% of all HS-6 lines were subject to any NTB. These consisted of some quantity restrictions but mostly authorization licenses, product standards and embargos/ prohibitions.<sup>24</sup> This implies that there would be little variation in NTBs to exploit in the 1994 data. But by 1997 that is no longer the case and, because of this and the fact that in 1997 we have additional information, such as *advalorem* equivalents that most closely match the theory predictions, we will focus on 1997. As far as we know the NTB information is not available for any other years.

By 1997, there had been two recent changes on Turkey's tariff constraints. First, it had started to implement additional bindings in the WTO, increasing the share of goods covered from 30% to about 47%, and reducing binding levels from about 41 to 30% on average. Second, it had signed a customs union with the EU where it committed to implement the EU's external tariffs, which led to a large reduction in Turkish applied MFN tariffs.

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<sup>23</sup> In the last election, the elected party's revenue share from private contributions was less than 0.1% whereas 92.5% was from state funding. Accessed at <[http://www.akparti.org.tr/gelir\\_gider/haziran.htm](http://www.akparti.org.tr/gelir_gider/haziran.htm)>

<sup>24</sup> There were also anti-dumping barriers, each applying only to a single country, rather than all countries as the other NTBs did. We focus on the latter because explaining anti-dumping requires much finer data and a model that is tailored to the industry, so it may not fit as well with our general theoretical framework.

In 1997 Turkey had considerably more NTBs than in 1994. They covered about 9% of all HS-6 products, with some NTB in at least a third of 97 different HS-2 industry classifications. This increase in NTBs is of course what our model predicts if the new tariff constraints are indeed binding. The NTBs applying to all countries were almost exclusively classified as authorization for imports, which can require for example a product satisfying certain criteria before being allowed into the country.

*Relative inefficiency of NTBs: a priori anecdotal evidence*

An interesting question is to what extent these NTBs are “less efficient” than tariffs in the sense required by the model. It is impossible to answer this for each product, but there is anecdotal evidence that on average they are being used for import protection motives and that they are relatively inefficient. When the WTO’s Trade Policy Report raised the issue of Turkish NTBs in 1998 the government claimed they were “intended to protect consumers or the environment”. This is a safe reply given that such a motive is allowed by the WTO. However, if those were the only reasons then why are the NTBs so trade restrictive? After all some safety standards can boost trade by increasing consumer confidence rather than reduce it (Kee et al, 2006, actually report finding some negative NTB AVE estimates, but unfortunately they do not specify for which countries and they attribute it to measurement error and censor them at zero). In fact, the estimated *advalorem* equivalent (AVE) for the typical good with an NTB in Turkey is over 30% and the average about 48%. Such high AVEs also increase the likelihood of rent seeking activities to obtain import authorizations, which should make the NTB less efficient than an equivalent tariff. Moreover, about half of the HS-6 lines with an NTB are concentrated on machinery and transport equipment, which accounted for about 40% of Turkey’s imports, suggesting the NTBs were aimed at trade protection.<sup>25</sup>

Fontagne et al (2001) try to distinguish if NTBs are used for protectionist motives using a simple procedure that we describe with the following example. If Turkey reports to the WTO that it imposed an NTB on a given good to address a consumer or environmental externality then we will give it the benefit of the doubt as long as several other countries do the same, otherwise the NTB is more likely to reflect a protectionist motive. Fontagne et al (2001) find that, across all importing countries in 1995-99, the WTO was notified of NTBs that were presumably aimed at such externalities for about three quarters of almost 5000 HS-6 goods. However, there is very little overlap across goods chosen by each of the 131 countries, only 1983 products are chosen by 5 or more countries (which can easily be due to the fact that several countries tend to use NTBs to protect certain sectors rather than true

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<sup>25</sup> It is also not obvious what the pressing consumer and environmental concern is for items like furniture, bedding, etc on which there are NTBs.

externality reasons) and only 185 are chosen by 34 or more countries. We match this sample of 185 goods to our data and find that Turkey has no NTBs in *any* of them.

This evidence strongly suggests that Turkey, and other countries, use these NTBs for protectionist motives rather than widely accepted concerns for consumer or environmental problems. Our model will actually provide structural estimates that indicate NTBs are indeed less efficient than tariffs, particularly in organized industries where NTBs are most likely used for protectionist motives.

#### 4.2 Impact of Commitment on NTBs: Econometric Specification and Baseline Results

We write the NTB econometric model for the population of products  $i$  in a given year as

$$NTB_i^* = \alpha + BIND_i * [ \beta + \beta_c f(t_i^c) + \beta_\varepsilon (1/\varepsilon_i) ] + \theta z_i + e_i \quad (E1)$$

where  $NTB_i^*$  represents a latent variable capturing the NTB, which maps into the observed NTB variable in different ways depending upon whether we estimate the likelihood of an NTB or its level, as we explain below. The theoretical model predicts an NTB AVE equal to eq. (12) in the presence of a binding tariff commitment and zero otherwise. Thus,  $BIND_i$  is an indicator for whether a product is subject to a binding tariff commitment and it is interacted with the set of variables in brackets.

According to the theoretical model, if we did not interact  $BIND_i$  with any variable then we should find that  $\beta > 0$ , if *on average* the products in which there is a tariff commitment reflect a binding tariff cap. Moreover, the higher the level of the tariff constraint,  $t_i^c$ , or of some positive function of it relative to its unconstrained level, denoted by  $f(t_i^c)$ , the lower the NTB; so  $\beta_c < 0$ . The model also suggests we include the inverse import demand elasticity measure when estimating the NTB AVE and according to (12)  $\beta_\varepsilon < 0$ . We follow the theory closely in our baseline estimates but in testing the robustness of the results we also allow for additional determinants for NTBs, which we include in  $z_i$ .<sup>26</sup>

The first measurement issue is determining on which products there is a commitment that actually binds. This is not as straightforward as it may seem since if there is a commitment to constrain a tariff, then we cannot simultaneously observe the unconstrained value of that tariff and hence we cannot *exactly* determine if the cap is binding or not. Our basic approach is to identify goods on which a formal constraint exists, e.g. if a country has a WTO tariff constraint on a product then we set  $BIND_i$  equal to 1 and zero otherwise. We refer to such a product as having a tariff binding, which is its common designation in the WTO. This correctly captures the goods for which there is no commitment as also not having a *binding* cap but misclassifies some with a non-binding commitment. Any resulting

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<sup>26</sup> In the baseline results we do not interact our variables with whether or not there is an organized lobby in the product because there is no organization data at this level. Thus we implicitly assume that all products are organized and any resulting measurement error is likely to generate attenuation bias. Subsequently, we analyze the effect of lobby organization at the *industry* level.

measurement error should cause attenuation bias and thus make it less likely for us to find significant support for the model's predictions. As we explain below, we then extend this basic approach to better capture if the commitment binds in the way suggested by the theory.

We first provide baseline results and then test their robustness, e.g. to endogeneity concerns.

#### *Likelihood of inefficient policies*

Table 2 presents the marginal effects from a Probit estimation based on (E1) where the dependent variable is equal to 1 if good  $i$  was subject to an NTB in 1997 and zero otherwise. In column 1 we find that a tariff commitment increases the probability of an NTB, as the model predicts for goods with binding commitment. In column 2, we also include the level of the tariff commitment and confirm that the higher it is the lower the probability of NTBs. We see that a tariff cap equal to zero, which is now the interpretation of the coefficient on  $BIND_i$ , increases the probability of an NTB by about 13% and that probability decreases as we relax the cap but only disappears at fairly high tariff constraints.

Using the level of the tariff constraint alone to proxy for whether it is likely to bind implicitly assumes the unconstrained tariff level is similar for all bound goods. But a commitment tariff of 20% may constrain one product and not another since, as we show in the theory section, the unconstrained tariff level can vary across industries. In fact, (12) shows that, at least for the NTB *advalorem* equivalent, we should include not only the constrained tariff but the difference between it and the *unobserved* unconstrained level, i.e. we should use  $f(.) = t_i^c - t_i^u$ .

The econometric issue we must address is how to measure  $t_i^u$ . We do so by constructing a counterfactual unconstrained level. For each product  $i$  with a tariff commitment in a given *industry I* we take the average of the applied tariff in 1993 (so it was pre-determined relative to the NTB) over the products with no commitment in industry  $I$  (which we define here as being in the same HS2 category).<sup>27</sup> Column 3 uses the difference between the binding level and this unconstrained variable and shows that the larger the binding relative to the unconstrained the lower the probability of an NTB.

One potential concern is that the binding status is simply proxying for some omitted variable that affects NTBs. We address this in two ways. First, we confirmed that the results in columns 1-3 are robust to including sector dummies (defined at the HS-1 level) to control for unobserved heterogeneity (these additional results are available on request). Second, we check if a more specific variable--the agreed implementation date of a tariff commitment--is insignificant and if binding status remains

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<sup>27</sup> In some cases where no unbound products are available in that HS2 we use products in the same HS1. We use the unconstrained level constructed from 1993 applied data, which may be more appropriate than the 1997 value since in that year even applied Turkish tariffs that were not bound in the WTO were subject to the constraint imposed by the common external tariff. However, the result in column 3 is qualitatively similar if we use 1997 data for the unconstrained level.

highly significant. This would be evidence that the binding status simply captures an omitted variable. We find evidence *against* this hypothesis in column 4, where we include a dummy for the subset of bound products for which the implementation was scheduled to have already begun by 1997. As we see the probability of an NTB is higher for those products and in fact binding status for products where implementation had not yet begun is individually insignificant (the variables are jointly significant). This strongly suggests that the variable is capturing the intended effect rather than an omitted factor.

We then test if the constraints on tariffs imposed by the customs union with the EU affected NTBs. In 1997, some of these commitments were still being phased in so we exploit this variation, i.e. the fact that at that time only 85% of products in our sample had to follow the common external tariff. Thus, the dummy variable for EU binding is analogous to  $BIND_i$  for the WTO commitment and we expect it to also be positive. We confirm this is the case in columns 5 and 6. In addition, the level of the constraint for the bound products is given by the EU external tariff, which is analogous to the WTO binding level and so it is expected to have a negative effect; this is what we find in column 5 and 6 (where we adjust that tariff using the Turkish unconstrained level, measured as before). The results for the WTO variables remain unchanged. Throughout we will include the WTO and EU constraints separately and allow the data to determine if they are significant.<sup>28</sup>

While according to our model the substitutability between tariff bindings and NTBs is expected, indeed predicted, we emphasize that alternative models could lead to the opposite relationship, e.g. if both policies were driven by a common omitted factor. In fact, the scant empirical evidence on this point indicates that in 1970 U.S. NTBs were more likely in industries with higher tariffs (Ray, 1981) and those where applied tariff cuts had been smallest (Marvel and Ray, 1983). The difference in results highlights the importance of carefully modeling and estimating the relationship between policies.

#### *Intensity of inefficient policies*

In order to quantify the impact of tariff commitments it is necessary to know how restrictive an NTB is. Moreover, the structural equation (12) of the NTB AVE gives us specific guidance about its determinants and functional form. Estimates based on that structural equation will be our baseline estimate but before that we provide some basic results analogous to the Probit.<sup>29</sup>

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<sup>28</sup> We do this both because the theory suggests their magnitudes may not be exactly identical and because in practice they cover different goods and have different binding levels. Moreover, even if one constraint is more restrictive in a given good in the EU, its impact on the NTB depends on whether the EU cares enough about this specific good to enforce the tariff binding, which it may not particularly in this implementation stage.

<sup>29</sup> The *advalorem* equivalents are estimated by Kee et al (2006) at the HS6 level for several countries. In the data appendix we briefly describe their estimation and the adjustment we make to use this data.

In columns 1 through 6 of Table 3 we regress the NTB AVE on the same set of variables used in Table 2. We find that binding the tariff of a product via the WTO or a customs union significantly increases the AVE. Tighter tariff constraints also increase the AVE significantly. This holds whether we use the tariff bindings in the WTO or the EU by themselves (column 5) or adjusted with the unconstrained Turkish tariff (column 6), as eq. (12) suggests.

The similarity to the Probit results is partly explained by the large share of censored observations, which imply the binary effect of bindings on whether to use an NTB is strong. But it is important to note that the constraints on tariffs also affect the restrictiveness of existing NTBs. Using column 6 for example we calculate that binding a product in the WTO *if it already* has an NTB and find it is about 10 pp (i.e. this is the difference of  $E(\text{NTB}|\mathbf{x},y>\text{NTB})$  between  $\text{WTO BIND}=1$  and 0). Similarly, the NTB AVE is higher for tighter WTO tariffs. The effects for the EU are also significant and of the expected signs. We discuss their magnitudes and implication for imperfect policy substitution in section 4.8.

The estimation using AVEs provides interesting quantitative results and shows that the commitment effect also occurs on the “intensive” margin of NTB protection and not just on its likelihood. Moreover, using AVEs will allow us to relate our estimates to the structural parameters in eq.(12). To do so we include the import demand elasticity measure in column (7). It has the predicted negative sign but it is imprecisely estimated, perhaps because it is imperfectly measured and affected by some outliers as we will see. The results on the remaining variables remain essentially unchanged.<sup>30</sup>

One other piece of evidence suggests that the binding effect is not simply capturing a correlation between all tariffs (bound and unbound) and NTBs. When we add the Turkish applied tariff for unbound products to a specification otherwise similar to column 5 in Table 3 we find that unbound tariffs are positively correlated with NTBs (result available on request). But the tariff effect via bound products remains negative and significant and a similar conclusion holds when we add this variable to the specifications in columns 6 or 7. This strongly suggests that the negative effect of tariffs on NTBs when the product is bound captures the channel highlighted by the model.

### **4.3 Impact of Commitment on NTBs: Endogeneity and Other Robustness Tests**

The baseline results in column (7) are robust to a variety of issues, which we now describe.

We follow the theory closely and so are parsimonious in the inclusion of regressors. This raises the possibility that an omitted variable, e.g. some unobserved political economy motive in Turkey, may

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<sup>30</sup> We adjust the import demand elasticity to exactly match the form it takes in eq. (12) and instrument for it using the elasticities of other countries. The reduction in the number of observations is due to the availability of elasticity estimates.

influence both its WTO binding decisions and NTB levels. We address this in two ways. First, in column 2 of Table 4 we control for unobserved heterogeneity using sector dummies. The results are qualitatively similar to the baseline (replicated in column (1)) with two caveats. First, the magnitude of the binding coefficients is lower (but still considerable). Second, the EU dummy effect can no longer be identified because it has essentially no variation within sectors since most of the exclusions were in agricultural products. Thus the remaining variation in this variable is spurious (it is equal to 1 for 98% of the sample in column 2) and so we attach little weight to it.

To address any omitted variable bias and other sources of endogeneity we also instrument the WTO binding and tariff. As instruments we employ the mean over the binding decision and tariff in any given good for five WTO members that do not trade much with Turkey but are broadly similar to it, particularly in their overall fraction of bound products. These variables are positively correlated with their Turkish counterparts, thus yielding reasonable first stage predictions. Moreover, these instruments pick up motives that are similar across countries for binding tariffs but *not* any Turkish-specific reasons for why it sets a particularly high (or low) tariff binding in a given good, i.e. the instrument avoids the source of variation in the binding most likely to be correlated with how it sets its NTBs.<sup>31</sup>

Column 4 of Table 4 presents the estimates of the IV procedure just described. The instrumented variables have the same sign as in the baseline and remain significant. However, the most important point is that we fail to reject exogeneity at a very high probability: 0.88 as seen at the bottom of the table. Note that in Tables 4 and 5 we report a similar exogeneity statistic for all other specifications. This statistic is derived from running the specification in that column *but* instrumenting the WTO binding variables. We cannot reject exogeneity in any of the specifications and therefore we focus on the more efficient estimates where these variables are treated as exogenous.

We also test the sensitivity of the results to fifteen outlier observations with AVEs greater than 170%, which is several times larger than the median over positive AVEs. Trimming these values does not alter the baseline results in a substantial way except to increase the impact and precision of the import elasticity variable, as we see in column 3 of Table 4.

Our model's predictions are derived for industries that are organized, i.e. those that lobby for trade protection. In practice it is very difficult to identify these precisely, as is well known in the literature (c.f. Goldberg and Maggi, 1999 and Bandyopadhyay and Gawande, 2000). Nonetheless, if we can find a reasonable proxy we can ask if the effects are stronger for those industries more likely to be organized. We do so in Table 5 where we use a standard measure of organization: if an industry in

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<sup>31</sup> The Turkish government had little or no saying on the EU commitment tariffs so we treat them as exogenous throughout.

Turkey lists an organization in the World Guide for Trade Associations. We find that the marginal effects for the significant variables are stronger for industries more likely to be organized, in column 2, than for the others, in column 3. Those effects are even more pronounced if we calculate elasticities. Moreover, the sign of the coefficient on the import demand elasticity is negative, as predicted, for the likely organized but positive for the other industries. In sum, there is evidence that the results are stronger for the industries one would expect if the model is correct. We find stronger evidence for this when we study a more specific model prediction regarding commitment.

Table 5 also provides additional evidence in the form of an alternative measure of NTB intensity: the coverage ratio. This measures the fraction of HS-8 sub lines in an HS-6 category with an NTB and was the standard measure of NTB intensity until AVEs became available. As we can see in column 4, the results are qualitatively similar to the AVE ones (magnitudes are obviously not comparable given they are not in similar scales). The conclusions of comparing the likely organized with other industries (in columns 5 and 6) are also similar. Thus, the qualitative results do not hinge on the specific measurement of NTB intensity.

In sum, the results in tables 2, 3, 4 and 5 indicate that constraints on tariffs via international agreements increase the probability of the use of NTBs in a given product. Moreover, they increase the restrictiveness of any given NTB used. These effects are dampened when the tariff is constrained at levels that are so high that they are effectively not binding, which is precisely what the theoretical model predicts. In addition, the effects appear to be related to the actual implementation dates of caps, present only for bound tariffs and stronger in industries likely to be organized. Thus the results provide strong support for several predictions of the model and we provide additional evidence of this in the quantification section.

#### **4.4 Impact of Bargaining Power on Policy Commitment: Data and Empirical Approach**

The model also predicts which goods a government prefers to constrain tariffs in and the level of that constraint. We analyze the WTO commitments since in the EU case the Turkish government had little or no choice. The basic econometric model is now given by

$$COMMIT_i = \alpha + \beta_\gamma g(BARG_I) + \mathbf{x}_i \boldsymbol{\theta} + e_i \quad (E2)$$

where  $\mathbf{x}$  represents a set of control variables and the latent variable  $COMMIT_i$  captures how restrictive the desired commitment tariffs,  $t^c$  or  $t^c - t^u$ , are. We focus on estimating whether  $\beta_\gamma$  is positive, i.e. whether the government prefers a less restrictive commitment when it has higher bargaining power relative to a SIG in a given industry, which is captured by  $BARG_I$ .

We only observe  $t_i^c$  for the subsample of products that are bound. According to the theory this is not a random sample, which is something we will confirm in the data. So, we need to account for the selection effect. The theory provides specific guidance on how to econometrically model it. First, the binding decision and its level depend on similar factors. Second, if we do not observe the commitment tariff it is because it would not bind, i.e. the desired commitment would have been higher than  $t_i^u$ . This strongly suggests a model with right censoring for  $t_i^c$  equal to  $t_i^u$  for the products that are not bound.

There are many potential variables that one could argue proxy for bargaining power. If we searched enough for the “appropriate” measure, we could certainly confirm the theoretical predictions. To avoid this pitfall we constrain ourselves to measuring bargaining power as closely as possible to theory. Binmore et al (1986) show that the Nash bargaining framework can be interpreted as a bilateral game of alternating offers, where the bargaining power parameter reflects the relative discount factors of agents. Thus if we denote the discount factors of the government and the lobby representing industry  $I$  by  $\delta_g$  and  $\delta_I$  respectively we can write bargaining power, i.e. the parameter  $\gamma$  from the *theory* section, as  $BARG_I = \delta_g / (\delta_g + \delta_I)$ .

The parameter  $\delta_g$  (or  $\delta_I$ ) can be thought of as the product of the probability that the government (or industry) survives another period and the weight it places on next period’s payoffs if it survives. In several contexts, the latter component is simply captured by a measure of the inverse interest rate that the government or industry have access to. In our baseline measure, we assume that all industries in a given country have access to the same rate and so the only relevant industry variation affecting  $BARG_I$  arises due to differences in their probability of survival; the lower that probability the higher  $BARG_I$  is.

We use  $(1 - \text{exit rate}_I)$  to capture the probability of survival of firms in industry  $I$ .<sup>32</sup> Given that we are considering a cross section for a single country, the government’s probability of survival or interest rate does not affect the estimated sign of the parameter  $\beta_\gamma$  in the regression. It is not obvious what the exact period length should be; we focus on a one year horizon but find the results are robust to longer periods such as four years. Given the potential for measurement error we use  $g(BARG_I)$  where  $g(\cdot)$  transforms  $BARG_I$  into categorical variables that divide industries into terciles.

#### 4.5 Bargaining Power and Commitment: Baseline Results

The model predicts that a government is more likely to constrain tariffs in products where it has low bargaining power. The results in Table 6 confirm this. They show that 59% of products in such

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<sup>32</sup> The basic intuition why this is a useful proxy can be understood if we take the extreme case where the SIG is formed and contains two firms, the only in the industry. When that SIG, i.e. those two firms, negotiate at time  $t$  with the government, the latter cares about whether or not those two firms will be present in the following period or exit. It places no value on new firms that may come in. Thus, if the number of firms expected to exit were 2, that lobby would have very little bargaining power at time  $t$  independently of the number of firms that are expected to enter the following period.

industries are bound whereas only 41% are bound in industries where the government has higher bargaining power (henceforth BP). The selection effect is even stronger for the subset of organized industries where the probability of binding is 22 percentage points higher in low bargaining power industries, a difference that is statistically and quantitatively significant. Moreover, for unorganized industries that difference is smaller, 9, and statistically equal to zero. Thus we only find a significant effect for the organized industries—exactly as the model predicts.

The results described above are robust to controlling for other regressors such as the number of exporters and exporter value concentration indices. As we noted in the theoretical section, a government can bind a product and then choose a high tariff, which effectively invalidates the impact of the commitment. Hence, rather than focusing on the probability of commitment separately we will consider it jointly with the restrictiveness of the commitment. Thus, in Table 7 we estimate the impact of bargaining power on the desired WTO tariff commitment using the described censoring procedure.

The first column of Table 7 shows that the government sets higher tariff bindings in industries where it has medium or high BP. The model predicts that the positive relationship should be present only in the organized industries. This is exactly what we find in column 2: the effect of the bargaining power measure is larger and more precise for organized industries than in the full sample. The effects are statistically different from zero even after clustering the standard errors to account for the fact that BP varies only by industry. Moreover, for the subset of unorganized industries in column 3, there is no effect at all despite the fact that in some of them the government has low and in others high BP.

To focus, as the theory did, on how restrictive the commitment is we also analyze  $t_i^c - t_i^u$ . The results above, which use  $t_i^c$ , provide direct evidence for the model's prediction only if  $t_i^u$  does not change much with BP. Rather than assuming this, we test it directly by employing  $t_i^c - t_i^u$  as the dependent variable. The right censoring point suggested by the model is now zero, i.e. if we do not observe the commitment tariff it is because it would not bind. In the last three columns of Table 7 we confirm that the government sets more restrictive tariff bindings in those industries in which it has low bargaining power and the effect is only significant for the organized ones.<sup>33</sup>

We find similar effects if instead of splitting the sample according to organization we employ interactions with the organization indicator (available on request). Thus even if the BP measure captured other industry characteristics unrelated to the political process in our model, the fact that its impact is of the correct sign and strong only for the organized industries supports the measure and the model's predictions.

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<sup>33</sup> We obtain similar results using a Heckman selection model, which also shows that bargaining power lowers the probability to bind but only in organized industries.

The theory assumes that Turkey is small in order to isolate the commitment channel. However, recent evidence by Broda, Limão and Weinstein (2008) suggests that even if the country is not large on aggregate its tariffs in *some* goods may still affect the prices received by foreign exporters. This generates an incentive for foreigners to lobby Turkey for lower commitments. To control for this incentive we include two additional regressors that are outside this model but featured in the tariff negotiation literature: the number of exporters and a Herfindahl index of export value in a given good. Ludema and Maya (2005) for example show that if the export sources of a good are highly concentrated then any given exporter is more likely to negotiate a tariff reduction; so we expect Turkey's tariff binding to be decreasing in the export Herfindahl index. Holding this concentration measure fixed, an increase in foreign exporters implies a larger pressure for Turkey to bind at lower levels. The results in Table 7 confirm the sign and significance of these effects. The results are similar if instead of the contemporaneous number of exporters and Herfindahl we employ lags (1994).

#### **4.6 Bargaining Power and Commitment: Non-parametric Evidence and Robustness Tests**

We now provide additional robustness checks and evidence for the model's predictions.

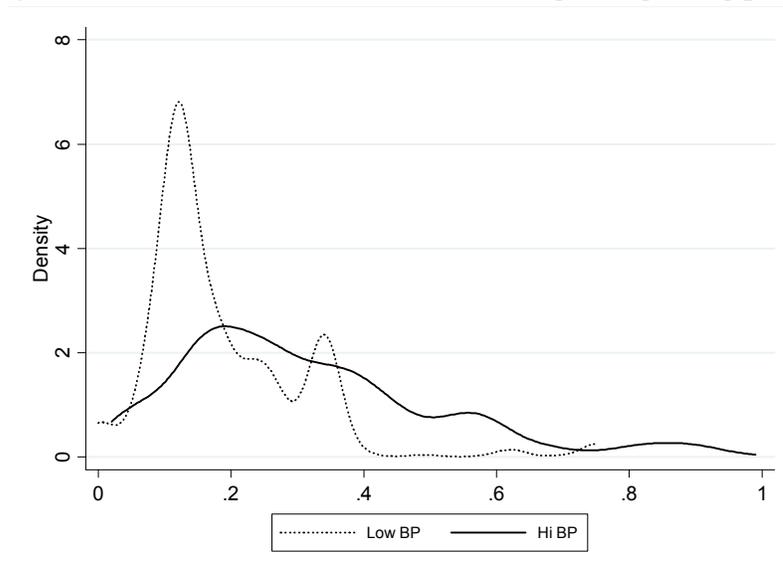
Given that about half of the observations are censored we analyze if the effect is still present under alternative censoring points. Since governments only get to bind tariffs at discrete points in time dictated by WTO rounds, they may want to constraint them in a given round even if the tariff ceiling does not bind currently, provided they believe it may bind at some point prior to the next round. In fact, the data show that on average  $t_i^c$  is about 10 percentage points higher than  $t_i^u$ . In Table 8 we shift the censoring point to reflect this amount and find that the results are robust to this and in fact become more precise both for  $t_i^c$  (column 2) and  $t_i^c - t_i^u$  (column 6). We find similar effects if we increase the censoring point further or if we focus on the organized subsample (available on request).

The model predicts that the difference in tariff commitments should be strongest when comparing the high with the low bargaining power industries. We confirm this and find that tariff bindings are at least 20 percentage points higher for industries where the government has high bargaining power relative to low and also larger for high than medium BP. Moreover, as we see in columns 3 and 4 of Table 8 this holds at alternative censoring points.

The evidence that high BP industries have higher commitment tariffs goes beyond the conditional means just presented. Figure 3 presents a kernel density estimate of the observed WTO tariff commitments. The dark line represents the subset of goods where BP is high and it is clearly

shifted to the right of the dashed one that represents the low BP goods. Thus high BP goods not only have higher mean commitment tariffs but also higher median, 75<sup>th</sup> percentile, etc.<sup>34</sup>

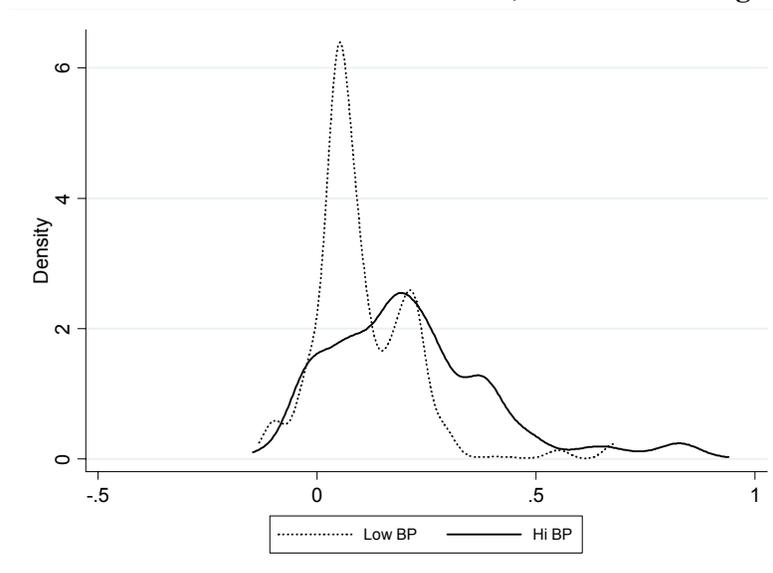
**Figure 3**  
**Kernel density of WTO tariff commitments: low vs. high bargaining power industries**



To provide additional non-parametric evidence for the model we must also show that the bindings are more restrictive when BP is low. We confirm this in Figure 4 that plots the kernel density estimates for  $t_i^c - t_i^u$ . When BP is low there is a large share of goods (dashed line) centered around zero, indicating that they have binding commitments. For high BP the median is over 20% indicating that a large share of these goods do not have binding commitments. In sum, there is evidence for the main prediction of the model across the whole distribution, not just the mean, and *even* if we focus only on the subsample of bound products, i.e. even if we ignore the selection effect.

<sup>34</sup> The figure excludes a few outliers with bound tariffs greater than 100% to better see the result; but the result is similar if we include them or focus on organized industries. A Kolmogorov-Smirnov test confirms the distribution difference.

**Figure 4**  
**Kernel density of restrictiveness of WTO commitments,  $t^c - t^u$ : low vs. high bargaining power**



#### 4.7 Bargaining Power and Commitment: Addressing Endogeneity Concerns

The specifications follow the model closely and are therefore parsimonious. Including the regressors described and controlling for organization mitigates the potential for omitted variable bias. Nonetheless, in this section we further address this possibility in three ways: (i) by providing some additional evidence that our measure captures bargaining power; (ii) testing if the results are unchanged after we control for plausible industry characteristics potentially correlated with this BP measure and bindings and (iii) by employing instrumental variables to directly address whether there is omitted variable bias or other sources of endogeneity.

To evaluate if the measure we employ generates a plausible bargaining power ranking we searched for industry redistribution outcomes unrelated to trade policy. Such data is rare, which is the reason we focused on the trade policies in the first place. However, Mitra et al (2002) provide government subsidy data for some Turkish industries. If our measure of government bargaining power captures what it is meant to then we should find that when it is low the industry can obtain higher subsidies than the median or average. That is what we find for all but one of the industries that we can match to their data. This further suggests that our BP ranking is reasonable.<sup>35</sup>

Even if our measure captured BP perfectly its correlation with tariff bindings could still be driven by omitted industry characteristics. One potentially important concern is that industries with higher exit rates (i.e. those where the government has higher BP) also have more volatile employment

<sup>35</sup> More specifically, Mitra et al (2002) contains 6 out of the 10 industries classified as low government BP in our data and 5 out of 6 of those have subsidies higher than the mean and median for their full sample.

and/or value-added. Governments can try to minimize such volatility for welfare reasons by maintaining relatively high tariff bindings so they can adjust up their tariff levels. While this is quite plausible, it cannot explain our results for two reasons. First, if our measure simply captured volatility and the government were setting bindings to minimize it for welfare reasons then in Table 7 we should also find that correlation for unorganized industries, which we do not. Second, what if the government only cares about volatility that affects its contributors, i.e. volatility in organized industries? To address this, we use variation in employment and value-added between 1990-96 to construct measures of volatility in each industry. When we control for these, in table 7b, we do find they have a positive but insignificant effect on the bindings. More importantly, the bargaining power effect remains unchanged.

It is impossible to control for all possible determinants of trade protection. However, there is one that is central in predicting higher protection in the leading model of trade protection, Grossman and Helpman (1994) and, as Helpman (1997) shows, is also central in several other political economy models. This determinant generally follows a specific functional form: the output to import ratio divided by import demand elasticity. We construct this ratio for 1993, i.e. prior to the setting of the bindings and include it in Table 7b. We find that this variable has a positive impact on bindings but its inclusion does *not* change the BP effect at all.<sup>36</sup>

We instrument for government's bargaining power using a combination of industry level variables. We employ the labor share of value added, the inverse of the number of establishments (a measure of concentration), gross fixed capital formation, and a Herfindahl index of the number of establishments. There are plausible economic arguments why each of these should be correlated with bargaining power.<sup>37</sup> These variables can also be thought of as affecting the subsequent probability of survival of firms in an industry (or 1-exit rate), which we used to construct BARG and are reasonably correlated with the variable (three out of the four instruments are individually statistically significant in the first stage). According to our model there is no obvious reason why these instruments should directly determine the tariff binding but to further justify their exclusion from the second stage, we

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<sup>36</sup> Our model also predicts this exact ratio should have a positive effect on *unconstrained* tariffs (see equation (8)). Thus, one possible reason for the correlation we find between this ratio and tariff *bindings* is that in some goods NTBs are not used and tariff bindings are set close to the unconstrained level.

<sup>37</sup> Some studies of the determinants of a firm's bargaining power relative to its workers have related it to variables such as capital intensity (Brock and Dobbelaere, 2006; Doiron, 1992), industry concentration (Veugelers, 1989; Dumont et al., 2006) and asset liquidity (Brock and Dobbelaere, 2006), among others. Some of these should also be correlated with firms' bargaining power relative to the government. A higher labor share generally implies a lower capital share in value added, indicating more flexibility of the industry in shifting resources to alternative uses and thus increasing its bargaining power. A similar argument applies to industries with lower gross fixed capital formation. A more concentrated industry may have more bargaining power due to larger market power and higher profits (although the evidence on the sign of this effect on bargaining power of the firm relative to the union is mixed—Dumont et al., 2006). Finally, the Herfindahl index of the number of establishments may measure the producers' ability to organize and cooperate, which would increase the industry's bargaining power.

construct the instruments for the period prior to the bargaining period, i.e. prior to 1994, so they were not affected by the tariff commitments we analyze, which were adopted *after* that date. Moreover, the overidentification allows us to provide some evidence for this exclusion: each of the instruments is insignificant when included in the second stage.

Table 9 presents the IV results and shows the results are qualitatively similar to the baseline specifications of Table 7. The magnitude of the results is similar, but we do not place much emphasis on this since we cannot reject exogeneity in any of the specifications. The exogeneity and the fact that we are instrumenting for a dummy in a censored regression setting leads us to focus on the more efficient estimates where we do not instrument.

#### 4.8 Inefficiency, Imperfect Substitution and Quantification of Estimates

We conclude by tying the theory and empirics in three ways. First, we estimate if the NTBs are indeed inefficient relative to tariffs. Second, we examine if NTBs are imperfect substitutes for tariffs, an outcome of the theory. Third, we quantify the role of bargaining power on tariff commitments and, via this channel, on NTBs.

Recall that eq. (12) defining the structural NTB AVE is only defined for non-negative AVEs and thus to relate the magnitudes of the findings to it we must focus on the marginal effects for non-negative AVEs, i.e.  $\partial E(y|\mathbf{x}, y>0) / \partial \mathbf{x}$ . We report these in Table 10 for the full sample and organized industries.

As we can see from eq.(12) the ratio of the parameter on the elasticity and the tariff constraint terms is  $\phi$ , the average inefficiency of NTBs relative to tariffs. Thus we can estimate it as  $\hat{\phi} = \hat{\beta}_\varepsilon / \hat{\beta}_c$  where  $\hat{\beta}_\varepsilon$  and  $\hat{\beta}_c$  are the estimated coefficients for the elasticity and tariff constraint variables respectively.<sup>38</sup> The estimates for  $\phi$ , shown at the bottom of Table 10, are in the predicted range—between zero and one—even though we did not restrict the estimation to ensure this. The value for the specification closest to the theory is 0.25 for organized industries (column 4), which indicates that, on average, a quarter of NTB rents, as defined in section 3.1, are lost relative to an equivalent tariff. Interestingly, we also find a similar estimate if we use the coverage ratio as the NTB measure.<sup>39</sup>

<sup>38</sup> Note that in table 10 we report  $\partial E(y|\mathbf{x}, y>0) / \partial x_j$ , which with Tobit yields  $\hat{\beta}_\varepsilon \mu(\mathbf{x}\boldsymbol{\beta}/\sigma)$  where  $\hat{\beta}_\varepsilon$  is the estimate of the structural parameter in (E1) and  $\mu(\mathbf{x}\boldsymbol{\beta}/\sigma)$  is the standard Tobit factor (between 0 and 1). Thus we cannot use the estimate for any individual variable in Table 10 to back out  $\phi$ . However, since  $\theta(\mathbf{x}\boldsymbol{\beta}/\sigma)$  is common to all variables we eliminate it by using the ratio  $\partial E(y|\mathbf{x}, y>0) / \partial x_\tau / \partial E(y|\mathbf{x}, y>0) / \partial x_\varepsilon = \hat{\beta}_\varepsilon / \hat{\beta}_c$ .

<sup>39</sup> This is plausible if for example the NTB AVE and coverage ratio are related as  $\tau_i = a + b\text{COV}_i + u_i$  such that eq. (12) would become  $\text{COV}_i = \frac{1}{b} \frac{1}{1-\phi} \left[ \frac{y_i(p_i)}{-ap_i^* m_i'} \Psi'(C_i) - \bar{t}_i^c \right] - \frac{1}{b} \frac{\phi}{1-\phi} \frac{1}{\varepsilon_i} - \frac{a+u_i}{b}$ . Thus the ratio of the coefficients on the elasticity and tariff constraint equals  $\phi$  and if  $u_i$  is uncorrelated with those variables then the magnitude of  $\hat{\phi} = \hat{\beta}_\varepsilon / \hat{\beta}_c$  should be similar across NTB intensity measures, as we find.

As we discuss in section 3.6, when the NTB is relatively inefficient it should be an imperfect substitute for tariffs in equilibrium, i.e.  $d\tau / dt^c \in (-1, 0)$ . Our findings in Table 10 do suggest there is imperfect substitution. For example, tightening a WTO tariff constraint by about 20 p.p. increases the NTB AVE by 4 p.p. in organized industries (column 4). A similar tightening of the EU constraint generates a larger increase in the NTB but one that is still not enough to offset the initial decrease in protection. One may argue that to capture the total rather than partial effect we should instead estimate a reduced form where we do not control for the unconstrained tariff level, as we do in columns 1 and 2. In this case there is even less policy substitution. Moreover, when we calculate 95% confidence intervals for all these estimates they lie precisely in the imperfect substitution range. This finding suggests that tariff commitments lead to a reduction in total protection—an important prediction of the model and a necessary condition for commitment to raise social welfare.

Given this evidence supporting a key theoretical assumption—the relative NTB inefficiency—and prediction—the imperfect policy substitution—it is important to also quantify the impact of the bargaining mechanism, both on tariff commitments directly and on NTBs. Table 7 shows that tariff constraints are stricter by about 20 percentage points in low BP industries. This is a significant amount, equivalent to the effect of adding pressure from about 12 extra exporters ( $=0.2/0.017$ )—almost a two standard deviation increase in that variable or alternatively, an increase of almost three standard deviations in the export concentration index emphasized by other tariff theories.

Clearly, bargaining power has a strong effect on tariff commitments. To estimate how it translates into higher NTBs we employ the following counterfactual: what is the change in the average NTB if the government treated all goods where it has medium or high BP as if it had low BP instead. To highlight the intensive and extensive margins of commitment and employ our existing estimates we approximate the effect by decomposing it into two channels: one via goods already bound and the other due to new bindings caused by the difference in BP. We summarize these here and explain their calculation in more detail in Table 11.

As we noted, for organized industries, the tariff commitment is tightened by 20 p.p. in industries where BP is low. Because of the imperfect substitution highlighted in table 10 this translates into a 4 p.p. increase in the NTB for each medium-hi BP good that was already bound. But there is an extra effect on NTBs since under low bargaining power an additional set of goods would be bound (an extra 0.22 as seen in Table 6). If these were bound at the average level of  $t^c - t^u$  predicted for low BP goods then the NTB for those goods increases by 7 p.p.

We can weight the first effect by the fraction of goods with medium-hi BP already bound (0.38) and the second by the fraction of newly bound goods (0.22) to obtain an average increase of 3 p.p. for the NTB AVE caused by the bargaining power channel. This is a significant effect relative to the average AVE over all the goods in the data,(about 3 p.p.), but modest relative to the average over the subset of products that already have a positive NTB AVE.

In sum, we find that bargaining power affects tariff commitments significantly and in that way increases the use of inefficient policies. However, we also find that NTBs are relatively inefficient and imperfectly substitute for tariffs, as the model suggests. Thus the increase in NTBs is unlikely to offset the decrease in tariff protection, particularly if the good's tariff was already bound.

## **5 CONCLUSION**

We analyze why relatively inefficient policies are used when more efficient ones are available to redistribute income towards SIGs. In order to tightly link the theory and estimation we focus on a specific model and a set of policies that are ubiquitous and economically important: tariffs vs. NTBs.

The model shows that the government of a small country bargaining with its domestic SIGs can gain by committing to limit the tariff levels through international trade agreements. Moreover, we show that the NTB increases with the difference between the unconstrained tariff value and the tariff binding (i.e., the stringency of the binding). We also show how the decision to commit depends on the government's bargaining power relative to SIGs.

Using detailed data, we test the predictions of the model for the case of Turkey and find that both tariff constraints imposed via the WTO and the PTA with the European Union increase the likelihood and restrictiveness of NTBs in those goods. Furthermore, these effects are stronger for more stringent tariff caps. We also construct a measure of bargaining power of the government versus SIGs and find that the probability that the government will choose to commit to bind a tariff, and the tightness of the binding, decrease with its bargaining power, as predicted by the model. The results are stronger for organized industries, as predicted by the model.

We also provide a structural estimate that shows that NTBs are indeed less efficient than tariffs in organized industries. The model predicts that in this case there is imperfect policy substitution and we find evidence supporting it. This evidence suggests that tariff commitments reduce total protection not simply in "partial political equilibrium", i.e. for given NTBs, but also when we take into account their effect on higher NTBs.

Future research should test if similar results are present for other countries' trade policies by applying a similar template to ours. It would also be interesting to do so with respect to other types of

policies. Finally, in order to obtain a more complete answer to the policy choice puzzle it is important to draw out specific testable equations from alternative theories (existing or new) and test them using detailed data.

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## DATA APPENDIX

### Data sources and construction details

DESCRIPTION	SYMBOL	SOURCE	CONSTRUCTION NOTES
Dummy for NTB	NTB	TRAINS	Indicator variable =1 if the HS-6 product had an NTB in 1997
NTB coverage ratio		TRAINS	Fraction of sub-lines within each HS-6 product with an NTB in 1997
NTB ad valorem equivalent	NTB AVE	Kee et al (updated)	Based on the trade value impact of an NTB indicator, which is converted into a price equivalent using a good specific import demand elasticity. We use their estimated AVE if NTB=1 in the TRAINS 1997 data and set it to 0 otherwise.
Import demand elasticity		Kee et al (updated)	We divide their measure by $(1+t+\tau)$ to obtain $\epsilon$ , as required by the model, where $1+t$ captures the tariff and AVE in that good. The instrument we employ for this is based on their (unadjusted) import demand elasticity in each good averaged over 5 countries =1 if tariff is bound by a WTO commitment, 0 otherwise.
WTO binding	B	WTO database*	=1 if tariff binding was scheduled to have already begun by 1997, = 0 otherwise.
WTO implementation in 1997		WTO database*	
WTO bound tariff	$t^c$	WTO database*	Binding tariff level
WTO binding x (WTO tariff-unconstrained)	$B \times (t^c - t^u)$	WTO database*	$t^u$ calculated as average applied tariff of unbound products in the same industry in 1993; =0 if B=0
EU binding	B	TRAINS	=1 if tariff is bound by a EU commitment, 0 otherwise.
EU binding x EU tariff		TRAINS	EU Binding x EU tariff level ; =0 if EU binding=0
EU binding x (EU tariff -unconstrained)		TRAINS	$t^u$ calculated as average applied tariff of unbound products in the same industry in 1993; =0 if EU binding=0

### Data sources and construction details (continued)

Bargaining power of government relative to industry	BARG <sub>1</sub>	Various	Construction of bargaining power is described in text. Industry survival rates are calculated as 1-exit rate where the exit rates are calculated at ISIC-level using census data on firms by Kaya and Üçdoğruk (2002), and then averages to ISIC-3 level to minimize measurement error. Government tenure is measured as the average annual probability of remaining in power for an extra year at the start of an electoral cycle and is calculated from publicly available data on government formation dates in Turkey between 1996-1999.
Medium bargaining			Bargaining power is split into three terciles, high, medium, and low bargaining power. Medium is the second tercile.
High bargaining			Bargaining power is split into three terciles, high, medium, and low bargaining power. High is the top tercile.
Medium-high bargaining Organization		World Guide to Trade Associations	Medium or High bargaining An industry is classified as organized if it contains an organization listed for Turkey in the 4th edition of the World Guide to Trade Associations. Raw electronic data provided by Bonnie Wilson and Dennis Coates. We matched the description of organization entries to ISIC 3 industries.
Number of exporters 97		TRAINS	Number of exporters per HS-6 to Turkey in 1997
Herfindahl of export value 97		TRAINS	Herfindahl index of exporter shares per HS-6 to Turkey in 1997

\* accessed via WITS (World Integrated Trade Solution)

**Table 1**  
**Summary Statistics**

Variable	Obs.	Mean	Std. Dev.	Min	Max
NTB indicator	5112	0.086	0.281	0	1
NTB coverage ratio	5112	0.059	0.213	0	1
NTB Ad-valorem equivalent (AVE)	5080	0.029	0.175	0	2.286
WTO BIND	5112	0.473	0.499	0	1
WTO implementation in 1997	5112	0.433	0.496	0	1
WTO BIND tariff ( $t^c$ )	2420	0.294	0.368	0	2.250
WTO BIND x tariff (B x $t^c$ )	5112	0.139	0.293	0	2.250
WTO BIND x (WTO tariff-unconstrained)	5112	0.095	0.272	-0.146	2.200
EU BIND	5112	0.853	0.354	0	1
EU BIND x EU tariff	4930	0.046	0.038	0	0.250
EU BIND x (EU tariff -unconstrained)	4930	-0.038	0.042	-0.250	0.118
Organization	5089	0.731	0.443	0	1
WTO BIND x 1/Import Elasticity	4632	0.718	1.684	0	47.340
Herfindahl of export value	5042	0.437	0.294	0	1
Number of exporters	5042	7.713	6.648	0	66
Medium-high bargaining	4598	0.700	0.458	0	1
Medium bargaining	4598	0.335	0.472	0	1
High bargaining	4598	0.364	0.481	0	1
Average inverse elasticity for 5 other WTO members	4665	1.063	0.980	0.082	36.999
Mean binding status for 5 other WTO members	5112	0.712	0.267	0	1
Mean binding tariff for 5 other WTO members	5035	0.325	0.186	0	1.650
Herfindahl of number of establishments	4513	0.496	0.283	0.173	1
Gross fixed capital formation	4598	238180	201374	4870	671517
Labor share of value added	4598	0.268	0.055	0.020	0.430
Inverse of number of establishments	4598	0.007	0.015	0.001	0.200

**Table 2**  
**Impact of international tariff commitments on the probability of NTB**

	(1)	(2)	(3)	(4)	(5)	(6)
WTO BIND ( $\beta > 0$ )	0.060*** [0.008]	0.127*** [0.009]	0.088*** [0.007]	0.013 [0.021]	0.112*** [0.010]	0.097*** [0.008]
WTO implementation in 1997				0.051** [0.022]		
WTO BIND x tariff ( $\beta_c < 0$ )		-0.369*** [0.029]			-0.236*** [0.040]	
WTO BIND x (WTO tariff-unconstrained) ( $\beta_c < 0$ )			-0.406*** [0.028]			-0.249*** [0.038]
EU BIND ( $\beta > 0$ )					0.076*** [0.006]	0.044*** [0.010]
EU BIND x EU tariff ( $\beta_c < 0$ )					-0.758*** [0.121]	
EU BIND x (EU tariff-Unconstrained) ( $\beta_c < 0$ )						-0.831*** [0.081]
Observations	5112	5112	5112	5112	4930	4930
Log-pseudolikelihood	-1472	-1396	-1384	-1470	-1348	-1304
Pseudo R2	0.02	0.07	0.08	0.02	0.09	0.12

Notes: Standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Marginal probit effects reported.

**Table 3**  
**Impact of Tariff Commitment on NTB Ad-valorem Equivalent**

	(1)	(2)	(3)	(4)	(5)	(6)	(7) <sup>a</sup>
WTO BIND ( $\beta > 0$ )	0.495*** [0.072]	1.053*** [0.102]	0.793*** [0.079]	-0.014 [0.200]	0.876*** [0.101]	0.794*** [0.079]	0.923*** [0.264]
WTO implementation in 1997				0.540*** [0.199]			
WTO BIND x tariff ( $\beta_c < 0$ )		-3.082*** [0.419]			-1.890*** [0.438]		
WTO BIND x (WTO tariff-unconstrained) ( $\beta_c < 0$ )			-3.504*** [0.434]			-1.982*** [0.427]	-2.014*** [0.462]
EU BIND ( $\beta > 0$ )					0.935*** [0.173]	0.350** [0.160]	0.306* [0.161]
EU BIND x EU tariff ( $\beta_c < 0$ )					-5.691*** [1.144]		
EU BIND x (EU tariff-Unconstrained) ( $\beta_c < 0$ )						-6.887*** [0.838]	-6.858*** [0.846]
WTO BIND x 1/elasticity ( $\beta_e < 0$ )							-0.118 [0.177]
Constant	-2.139*** [0.124]	-2.059*** [0.118]	-2.051*** [0.118]	-2.128*** [0.123]	-2.653*** [0.211]	-2.720*** [0.211]	-2.603*** [0.210]
Observations	5080	5080	5080	5080	4898	4898	4496
Log-likelihood	-1207	-1155	-1147	-1203	-1128	-1096	n/a
Pseudo R2	0.02	0.06	0.07	0.03	0.08	0.11	n/a

Notes: Standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

(a) All specifications except this one use Tobit. This one employs a two-step IVTOBIT where we instrument for the elasticity measure (adjusted to correspond our model) by using the average of inverse elasticity for five other WTO members: India, Malaysia, Philippines, Thailand and Tunisia. The lower number of observations is due to unavailable elasticity data. Imputing the missing elasticities using the mean leads to very similar results.

**Table 4**  
**Impact of Tariff Commitment on NTB AVE: Robustness Tests**

<i>Robustness</i>	(1) <i>Baseline</i>	(2) <sup>a</sup> <i>Sector effects</i>	(3) <sup>b</sup> <i>No outliers</i>	(4) <sup>b,c,d</sup> <i>IV WTO bindings</i>
WTO BIND ( $\beta > 0$ )	0.923*** [0.264]	0.633*** [0.226]	1.075*** [0.258]	0.779* [0.437]
WTO BIND x (WTO tariff-unconstrained) ( $\beta_c < 0$ )	-2.014*** [0.462]	-0.803* [0.448]	-1.506*** [0.394]	-2.036* [1.111]
EU BIND ( $\beta > 0$ )	0.306* [0.161]	-0.326* [0.193]	0.186 [0.136]	-0.096 [0.372]
EU BIND x (EU tariff-Unconstrained) ( $\beta_c < 0$ )	-6.858*** [0.846]	-2.747*** [0.841]	-5.997*** [0.748]	-5.675*** [0.863]
WTO BIND x 1/elasticity ( $\beta_c < 0$ )	-0.118 [0.177]	-0.136 [0.146]	-0.318* [0.178]	-0.316* [0.179]
Constant	-2.603*** [0.210]	-1.161*** [0.211]	-2.158*** [0.179]	-1.731*** [0.491]
Observations	4496	3568	4481	4478
Wald exogeneity test: p-value <sup>d</sup>	0.93	0.58	0.88	0.88

Notes:

Specifications (1), (2) and (3) employ a two-step IVTOBIT where the elasticity variable is instrumented as in Table 3. Similar coefficients obtained using a ML IVTOBIT. We report two-step results for comparability (see note (c) below).

Standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

- (a) Sector effects captured by HS-1 dummies defined in the harmonized tariff schedule. The difference in sample size relative to the baseline is due to the removal of observations without AVE variation in a given sector.
- (b) Drops outlier observations with NTB AVE > 170%.
- (c) Specification (4) treats as endogenous not only the elasticity but also the WTO variables and instruments the latter two using the mean (in each given good) of WTO binding status and tariff across the same 5 WTO members used to calculate the instrument for the elasticity. Given the multiple endogenous regressors we employ a two-step IV TOBIT (Newey's minimum chi-squared estimator). There are three missing observations for these instruments. Despite the fact that one of the endogenous regressors is a dummy we can still test the null hypothesis of exogeneity, as reported on the bottom row.
- (d) Probability at which we reject the null of exogeneity for the equivalent regression where the WTO variables are treated as endogenous. For example, in the case of (3) the equivalent regression is simply (4) and thus the Wald test values are identical, 0.88.

**Table 5**  
**Impact of Tariff Commitment on NTB: Lobby organization and alternative NTB measures**

<i>Dependent variable</i>	(1)	(2)	(3)	(4)	(5)	(6)
	<i>NTB Ad-valorem equivalent</i>			<i>NTB coverage ratio<sup>b</sup></i>		
	<i>Sample</i>	<i>Full</i>	<i>Organized<sup>a</sup></i>	<i>Unorganized</i>	<i>Full</i>	<i>Organized<sup>a</sup></i>
WTO BIND ( $\beta > 0$ )	0.923*** [0.264]	0.945** [0.406]	0.532** [0.220]	2.029*** [0.503]	3.238*** [0.988]	0.739** [0.324]
WTO BIND x (WTO tariff-unconstrained) ( $\beta_c < 0$ )	-2.014*** [0.462]	-2.084*** [0.629]	-1.592** [0.649]	-3.286*** [0.829]	-3.963*** [1.395]	-2.120** [0.980]
EU BIND ( $\beta > 0$ )	0.306* [0.161]	0.065 [0.187]	0.213 [0.315]	0.856*** [0.301]	0.676 [0.435]	0.562 [0.516]
EU BIND x (EU tariff-Unconstrained) ( $\beta_c < 0$ )	-6.858*** [0.846]	-7.329*** [1.092]	-5.274*** [1.382]	-12.98*** [1.615]	-14.25*** [2.571]	-12.54*** [2.287]
WTO BIND x 1/elasticity ( $\beta_\epsilon < 0$ )	-0.118 [0.177]	-0.204 [0.280]	0.05 [0.127]	-0.483 [0.336]	-1.209* [0.670]	0.057 [0.189]
Constant	-2.603*** [0.210]	-2.509*** [0.268]	-1.949*** [0.335]	-4.848*** [0.432]	-5.878*** [0.713]	-3.177*** [0.571]
Observations	4496	3295	1186	4496	3295	1186
Wald exogeneity test: p-value <sup>c</sup>	0.93	0.77	0.83	0.65	0.53	0.91

Notes: Standard errors in brackets. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

All specifications employ a two-step IVTOBIT where WTO BINDx1/elasticity is instrumented as in Table 3.

- (a) An industry is classified as organized if it contains an organization listed for Turkey in the 4<sup>th</sup> edition of the World Guide to Trade Associations. Raw electronic data generously provided by Bonnie Wilson and Dennis Coates. Authors matched the description of organization entries to ISIC 3 industries.
- (b) Applies a two-limit maximum likelihood IV Tobit (at 0 and 1)
- (c) Probability at which we reject the null of exogeneity for the equivalent regression where WTO *BIND* and WTO BIND x ( $t^c - t^d$ ) are also treated as endogenous.

**Table 6**  
**Impact of bargaining power on WTO commitments: product binding probability**

	<i>Sample</i>	<i>All</i>	<i>Organized</i>	<i>Unorganized</i>
Low bargaining power		0.59	0.60	0.58
Medium-High bargaining power		0.41	0.38	0.49
<b>Difference</b>		<b>0.18*</b> <b>[0.10]</b>	<b>0.22*</b> <b>[0.13]</b>	<b>0.09</b> <b>[0.11]</b>
Observations		4598	3255	1343

Notes: Standard errors in brackets clustered at isic 3 based on a maximum likelihood probit using the medium-high bargaining power dummy for each relevant sample.

**Table 7: Impact of Bargaining Power on Desired WTO Commitment Tariffs**  
**(7A) Organized vs. Unorganized Industries**

Dependent variable	Tariff Binding Level <sup>a</sup>			Tariff Binding – Unconstrained <sup>b</sup>			
	<i>Estimation method</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	
	Sample	All	Organized	Unorganized	All	Organized	Unorganized
Medium-high bargaining ( $\beta_\gamma > 0$ )		0.147* [0.084]	0.230*** [0.084]	-0.046 [0.070]	0.127 [0.083]	0.199** [0.087]	-0.043 [0.065]
Number of exporters		-0.015** [0.006]	-0.016** [0.007]	-0.005** [0.003]	-0.016** [0.006]	-0.017*** [0.007]	-0.005* [0.002]
Herfindahl of export value		-0.168* [0.094]	-0.232** [0.098]	0.051 [0.047]	-0.169* [0.099]	-0.234** [0.102]	0.054 [0.047]
Constant		0.498*** [0.135]	0.523*** [0.140]	0.308*** [0.078]	0.418*** [0.138]	0.456*** [0.145]	0.204*** [0.070]
Observations		4546	3210	1336	4546	3210	1336
Pseudo R2		.03	.045	.026	.032	.047	.026

Notes: Standard errors in brackets clustered at isic 3. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. (a) Right censored at  $t_i^c > t_i^u$  for goods not bound. (b) Right censored at  $t_i^c - t_i^u > 0$  for goods not bound.

**Table 7B Robustness to Alternative Organized Industry Characteristics**

Dependent variable <i>Estimation method</i>	Tariff Binding Level <sup>a</sup>			Tariff Binding – Unconstrained <sup>b</sup>		
	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>	<i>Censor.</i>
	Organized	Organized	Organized	Organized	Organized	Organized
Medium-high bargaining ( $\beta_{\gamma} > 0$ )	0.243*** [0.093]	0.206** [0.087]	0.211** [0.083]	0.212** [0.096]	0.168* [0.091]	0.182** [0.086]
Number of exporters	-0.016** [0.007]	-0.016** [0.006]	-0.016** [0.007]	-0.017** [0.007]	-0.017*** [0.006]	-0.017*** [0.006]
Herfindahl of export value	-0.235** [0.100]	-0.233** [0.098]	-0.232** [0.099]	-0.237** [0.104]	-0.236** [0.102]	-0.234** [0.104]
Variance log employment	2.594 [3.868]			2.482 [3.890]		
Variance log value added		1.752 [2.762]			2.288 [2.757]	
Output-import ratio/imp. dem. Elasticity			0.001** [0.000]			0.001** [0.001]
Constant	0.495*** [0.128]	0.496*** [0.134]	0.516*** [0.138]	0.430*** [0.131]	0.420*** [0.136]	0.449*** [0.143]
Observations	3210	3210	3210	3210	3210	3210

Notes: Standard errors in brackets clustered at isic 3. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. (a) Right censored at  $t_i^c > t_i^u$  for goods not bound. (b) Right censored at  $t_i^c - t_i^u > 0$  for goods not bound.

**Table 8**  
**Impact of Bargaining Power on Desired WTO Commitment Tariffs (1997): Robustness**

Dependent variable <i>Estimation method</i>	Tariff Binding Level				Tariff Binding-Unconstrained			
	<i>Cens</i> (1)	<i>Cens</i> (2)	<i>Cens</i> (3)	<i>Cens</i> (4)	<i>Cens</i> (5)	<i>Cens</i> (6)	<i>Cens</i> (7)	<i>Cens</i> (8)
Medium-high bargaining ( $\beta_\gamma > 0$ )	0.147* [0.084]	0.178** [0.076]			0.127 [0.083]	0.157** [0.074]		
High bargaining ( $\beta_\gamma > 0$ )			0.232*** [0.079]	0.246*** [0.061]			0.213*** [0.080]	0.226*** [0.060]
Medium bargaining ( $\beta_\gamma > 0$ )			0.053 [0.075]	0.100 [0.093]			0.033 [0.069]	0.078 [0.086]
Number of exporters	-0.015** [0.006]	-0.016*** [0.005]	-0.012** [0.005]	-0.014*** [0.004]	-0.016** [0.006]	-0.016*** [0.005]	-0.013** [0.005]	-0.014*** [0.005]
Herfindahl of export value	-0.168* [0.094]	-0.164* [0.086]	-0.171* [0.094]	-0.165* [0.086]	-0.169* [0.099]	-0.164* [0.091]	-0.172* [0.098]	-0.164* [0.090]
Constant	0.498*** [0.135]	0.568*** [0.118]	0.469*** [0.125]	0.543*** [0.114]	0.418*** [0.138]	0.486*** [0.122]	0.388*** [0.129]	0.461*** [0.118]
Observations	4546	4546	4546	4546	4546	4546	4546	4546
Censoring point	$t_i^u$	$t_i^u + 0.1$	$t_i^u$	$t_i^u + 0.1$	0	0.1	0	0.1

Notes: Standard errors in brackets clustered at isic 3. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 9**  
**Impact of Bargaining Power on Desired WTO Commitment Tariffs: Instrumental Variables**

Dependent variable <i>Estimation method</i> Sample	Tariff Binding Level			Tariff Binding-Unconstrained		
	<i>IV Tobit</i>	<i>IV Tobit</i>	<i>IV Tobit</i>	<i>IV Tobit</i>	<i>IV Tobit</i>	<i>IV Tobit</i>
	All (2)	Organized (3)	Unorganized (4)	All (6)	Organized (7)	Unorganized (8)
Medium-high bargaining ( $\beta_\gamma > 0$ )	0.203*** [0.071]	0.261*** [0.098]	0.088 [0.248]	0.214*** [0.072]	0.259*** [0.089]	0.052 [0.186]
Number of exporters	-0.016** [0.007]	-0.017** [0.007]	-0.005 [0.005]	-0.016*** [0.006]	-0.017*** [0.007]	-0.005 [0.004]
Herfindahl of export value	-0.167* [0.095]	-0.232** [0.099]	0.051 [0.049]	-0.167* [0.097]	-0.232** [0.101]	0.053 [0.046]
Constant	0.432*** [0.150]	0.476*** [0.120]	0.189** [0.088]	0.363** [0.142]	0.417*** [0.118]	0.144** [0.074]
Observations	4461	3183	1278	4461	3183	1278
Wald test exog. (P-value)	0.38	0.33	0.37	0.24	0.21	0.43

Notes: Standard errors in brackets clustered at isic 3. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. Bargaining power instrumented using labor share of value added, the inverse of the number of establishments (a measure of concentration), gross fixed capital formation, and a Herfindahl index of the number of establishments between 1990-1993 via a maximum likelihood IV Tobit. The reduction in the number of observations is due to missing data for the number of establishments.

**Table 10**  
**NTB Inefficiency and Imperfect Substitution Estimates**

<i>Sample</i>	(1)	(2)	(3)	(4)
	<i>Full</i>	<i>Organized</i>	<i>Full</i>	<i>Organized</i>
WTO BIND ( $\beta > 0$ )	0.12***	0.13***	0.12***	0.11***
WTO BIND x tariff ( $\beta_c < 0$ )	-0.16***	-0.11*		
WTO BIND x (WTO tariff-unconst.) ( $\beta_c < 0$ )			-0.20***	-0.19***
EU BIND ( $\beta > 0$ )	0.086***	0.065***	0.02	-0.01
EU BIND x EU tariff ( $\beta_c < 0$ )	-0.78***	-0.49***		
EU BIND x (EU tariff-unconst.) ( $\beta_c < 0$ )			-0.79***	-0.80***
WTO BIND x 1/elasticity ( $\beta_\epsilon < 0$ )	-0.048*	-0.059	-0.04	-0.05
Observations	4481	3288	4481	3288
<i>NTB Inefficiency: <math>\hat{\phi} = \hat{\beta}_\epsilon / \hat{\beta}_c \in (0, 1]</math></i>	0.30	0.54	0.21	0.25
<i>Imperfect policy substitution: <math>d\tau / dt^c \approx \hat{\beta}_c \in (-1, 0)</math></i>	-0.16	-0.11	-0.20	-0.19

Notes: (a) All specifications employ a ML IVTOBIT where we instrument for the elasticity measure as in Tables 3, 4, 5. (b) The reported marginal effect for each variable  $x_j$  is calculated as  $\partial E(y|x, y > 0) / \partial x_j$  and equals  $\beta_j \mu(\mathbf{x}\beta/\sigma)$  where  $\beta_j$  is the structural parameter in E(1) and  $\mu(\mathbf{x}\beta/\sigma)$  is the common Tobit factor evaluated at WTO BIND= EU BIND=1, EU tariff = WTO tariff = unconstrained and at mean of 1/elasticity. (c) \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%. (d) All specifications exclude outliers as defined before.

**Table 11**  
**Impact of Bargaining Power on NTB AVE via WTO Tariff Commitments**

<i>Sample:</i>	<i>All</i>	<i>Organized</i>
Channel (affected goods)		
Existing tariff commitment	3 p.p.	4 p.p.
New tariff commitment	7 p.p.	7 p.p.
Average	2 p.p.	3 p.p.

Notes: Values represent the percentage point increase in the NTB advalorem equivalent if the government had low bargaining power instead of medium or high and changed tariff commitments as predicted by the model. The effect via existing commitments for organized industries is approximately  $100 * .04 = 100 * (-0.2) * (-.19)$  where -0.2 is the predicted tariff effect from switching to low (estimated from Table 7), -0.19 is the effect of that tariff commitment change on the NTB from table 10 column 4. This affects the fraction of bound products with medium-hi BP, which is 0.38 (Table 6). The new tariff commitment effect is approximately  $100 * 0.07 = 100 * (0.11 - 0.19 * 0.22)$  where the marginal coefficients 0.11 and -0.19 are from Table 10 and 0.22 is the average level of  $t^c - t^u$  for low BP (estimated from Table 7). This applies to 0.22 of goods that would be newly bound where this extra probability of binding is from Table 6. The average change over all goods assumes the only NTB changes occur on the 0.38 of bound and 0.22 of newly bound so it equals  $.38 * 4 + .22 * 7$ .

# Appendix A

**Proof:**  $t^c < t^u$  when NTB is unavailable.

Proof by contradiction: if  $t^u = t^c$  then  $C$ ,  $p$  and  $m'$  are identical under both equilibria. Using this we show that the RHS of the constrained tariff,  $t^c$ , in equation (10) is actually lower than the RHS of the unconstrained tariff expression in (8) and hence the constraint binds.

$$\begin{aligned} -\frac{C_t \Psi'}{a(p^*)^2 m'} &< -\frac{y \Psi'}{a p^* m'} \\ C_t &< p^* y \\ C_t &< \Pi_t \end{aligned}$$

If they are equal then we should use  $C_t$  from the unconstrained problem, which we obtain from implicitly differentiating the FOC for  $C$  in (5)

$$C_t = -\frac{\gamma V_t \Psi' - (1 - \gamma) G_t}{\gamma(-\Psi' + [V - V_0] \Psi'') - (1 - \gamma) \Psi'}$$

If the tariff is the same than under the unconstrained equilibrium then  $G_t/G_C = V_t/V_C$ , and therefore  $G_t = -\Psi' V_t$ . Replacing and simplifying

$$\begin{aligned} C_t &= \frac{\gamma V_t \Psi' - (1 - \gamma)(-\Psi' V_t)}{\Psi' - \gamma([V - V_0] \Psi'')} \\ &= \frac{\Psi' V_t}{\Psi' - \gamma([V - V_0] \Psi'')} \end{aligned}$$

So the condition  $C_t < \Pi_t (=V_t)$  is

$$\begin{aligned} \frac{\Psi' V_t}{\Psi' - \gamma([V - V_0] \Psi'')} &< V_t \\ \Psi' &< \Psi' - \gamma([V - V_0] \Psi'') \\ 0 &> \gamma[V - V_0] \Psi'' \end{aligned}$$

which must hold because: (a)  $\Psi'' < 0$  and (b)  $V > V_0$  for all  $\gamma < 1$ . This makes it clear that as long as the government has some but not all the bargaining power and lobby goods have diminishing marginal utility so utility is not transferable at a constant rate, the government prefers to commit to a binding tariff constraint. If  $\gamma = 0$  the government would be indifferent about setting a cap since it would receive the reservation payoff either way.

## Simulation

The following shows that the condition in section 3.5 can be satisfied so the government commits to a tariff constraint if the cap is not too stringent.

*Assumptions:*

$$\Psi \equiv C^n, n \in (0, 1)$$

$$y \equiv k^{1-\alpha} l^\alpha \implies \pi(p) = (1 - \alpha) p k (p \alpha)^{\frac{\alpha}{1-\alpha}}$$

$$u(x) = Bx - \frac{b}{2} x^2 \implies d(p) = \frac{1}{b} (B - p)$$

$$p^* = k = b = a = N = 1, n = \alpha = 0.5, \gamma = 0, B = 3$$

$B$  was chosen to ensure positive imports in equilibrium;  $\gamma$  because we are evaluating a limit condition; and the remaining mostly for computational simplicity and to match the model's assumptions.

*Slope condition for tariff*

The unconstrained tariff level  $t^u$  is implicitly defined by the efficiency condition  $G_t/G_C = V_t/V_C$  for a given contribution level

$$\Psi'(C^{mt}) = -a \frac{t^u (p^*)^2 m'(p^*(1+t^u))}{p^* y(p^*(1+t^u))}$$

where  $C^{mt}$  is the minimum level of the good provided by the lobby required to maintain the government at the reservation utility.

We can define the Pareto frontier when  $t$  is used as  $V^t - v^0 = \Omega^t(G^t - g^0)$ . The condition we describe in the text can then be written as

$$\begin{aligned} \lim_{\gamma \rightarrow 0} -\Omega^t/\Omega'^t &= \lim_{\gamma \rightarrow 0} (V^t - v^0) \Psi'(C^t) \\ &= [(\pi(\cdot) - \pi(p^*) - C^{mt}) (-a \frac{t^u (p^*)^2 m'(\cdot)}{p^* y(\cdot)})]_{\gamma=0} \end{aligned}$$

where  $\pi(\cdot) \equiv \pi(p^*(1+t^u))$ , similarly for  $m'(\cdot)$  and  $y(\cdot)$ . The first equality is due to the definition of  $\Omega$ , and the fact that the slope of the Pareto frontier in G-V space is  $-1/\Omega^t$ . It equals  $\Psi'(C^t)$  at any given equilibrium as this is the ratio at which utility is traded as contributions are used, i.e.  $G_C/V_C$ . The expression for  $\Psi'(C^t)$  in the second equality is derived from the efficiency condition given above. Using the definition of  $V$  we obtain  $\lim_{\gamma \rightarrow 0} (V^t - v^0) = \pi(p^*(1+t^u(\gamma=0))) - C^{mt} - \pi(p^*)$ . Using the definition of  $G$  and the condition  $G(t=0, \tau=0, C=0) = G(t=t^u(\gamma=0), \tau=0, C^{mt})$  (recalling that in the unconstrained equilibrium  $\tau=0$ ), we can write  $C^{mt}$  as:

$$C^{mt} = \lim_{\gamma \rightarrow 0} \Psi^{-1}(a[\pi(p^*) + Ns(p^*) - \{\pi(\cdot) + Ns(\cdot) + t^u p^* m(\cdot)\}])$$

Using the expressions derived above for  $\lim_{\gamma \rightarrow 0} -\Omega^t/\Omega'^t$  and  $C^{mt}$ , and using the functional forms for  $\pi(p)$ ,  $d(p)$  and  $\Psi(\cdot)$  as well as the parameter values listed we obtain:

$$\lim_{\gamma \rightarrow 0} -\Omega^t/\Omega'^t = 0.1875 (t^u)^2 \frac{8 + 4t^u - 9(t^u)^3}{1 + t^u}$$

To evaluate this expression we require the equilibrium  $t^u$ , which is calculated by plugging in the expression for  $C^{mt}$  above and the functional form assumptions into the efficiency condition  $G_t/G_C = V_t/V_C$  previously defined.

*Slope condition for NTB*

The equilibrium condition for the NTB is the one in equation (11) in the text:

$$\Psi'(C^{m\tau}) = -a \frac{(\tau(1-\phi) + t^c)(p^*)^2 m'(\cdot) - \phi p^* m(\cdot)}{p^* y(\cdot)} \quad (1)$$

where the domestic price is  $p = p^*(1 + \tau + t^c)$  so  $m'(\cdot) \equiv m'(p^*(1 + \tau + t^c))$  and similarly for  $m$  and  $y$ .

The ratio for the NTB is

$$\begin{aligned} \lim_{\gamma \rightarrow 0} -\Omega^\tau/\Omega'^\tau &= \lim_{\gamma \rightarrow 0} (V - v^0) \Psi'(C^\tau) \\ &= [(\pi(\cdot) - \pi(p^*) - C^{m\tau}) (-a \frac{(\tau(1-\phi) + t^c)(p^*)^2 m'(\cdot) - \phi p^* m(\cdot)}{p^* y(\cdot)})]_{\gamma=0} \end{aligned}$$

If the cap were zero and  $\phi = 0$  then the expression is identical to the tariff's, as expected. We also have:

$$C^{m\tau} = \lim_{\gamma \rightarrow 0} \Psi^{-1}(a[\pi(p^*) + Ns(p^*) - \{\pi(\cdot)\} + Ns(\cdot) + (\tau(1 - \phi) + t^c)p^*m(\cdot)])$$

Using the expressions derived for  $\lim_{\gamma \rightarrow 0} -\Omega^\tau/\Omega'^\tau$  and  $C^{m\tau}$ , and for  $\pi(p)$ ,  $d(p)$  and  $\Psi(\cdot)$  as well as the parameter values we obtain:

$$\begin{aligned} \lim_{\gamma \rightarrow 0} -\Omega^\tau/\Omega'^\tau &= \left\{ -\frac{1}{4}(1 - (1 + \tau + t^c)^2) \right. \\ &\quad \left. - \left( \left( \left( \frac{1}{4}(1 - (1 + \tau + t^c)^2) + \frac{1}{2}((t^c + \tau)(4 - \tau - t^c)) - \left( \frac{1}{2}(\tau(1 - \phi) + t^c)(3 - 3(\tau + t^c)) \right) \right) \right)^2 \right. \right. \\ &\quad \left. \left. \times \frac{3(t^c - \phi t^c + \tau + \phi - 2\tau\phi)}{1 + \tau + t^c} \right) \right\} \end{aligned}$$

Using  $\phi = 0.3$  and a value for  $t^c$  we solve for the equilibrium  $\tau$  using (11) and replace it above to obtain the values in the table. The first row corresponds to a cap that is half the equilibrium value of the unconstrained tariff under this set of parameters. The second row is for  $t^c = 0.85t^u$ .

$\lim_{\gamma \rightarrow 0} -\frac{\Omega^x}{\Omega'^x}$			
$t^c$	$x = \tau$		$x = t$
$0.5t^u$	0.37	<	0.43
$0.85t^u$	0.44	>	0.43
Parameters $p^* = k = b = a = N = 1, n = \alpha = 0.5, \gamma = 0, B = 3, \phi = 0.3$			
Functions $\Psi = C^m; q = k^{1-\alpha}l^\alpha, u(x) = Bx - \frac{b}{2}x^2$			

**Table 1:** Simulation result for the choice of tariff versus NTBs

Notes: Similar inequalities for  $t^c = 0.85t^u$  also hold for  $\phi=0.1, 0.2, 0.4$

## Calculation of Total Protection and Welfare effects of Commitment (Figure 2)

- Percent change in total protection. Defined as  $(\tau(\phi) + t^c)/t^u$  where  $t^u$  and  $\tau(\phi)$  are calculated as described above, we calculate  $\tau(\phi)$  for  $\phi = 0, .1, .2, .3, .4$ ;  $t^u$  is independent of  $\phi$ . We use  $t^c = 0.85t^u$  to satisfy the government sufficient condition to commit shown above.
- Percent change in welfare. Defined as  $(W_i^c - W_i^u)/W_i^u$  where  $W_i^x$  measures welfare under commitment ( $x=c$ ) or in its absence ( $x=u$ ) as  $W_i(p_i) \equiv \pi_i(p_i) + N[r_i(p_i, \phi) + s_i(p_i)]$ . for a good  $i$  that is imported. We can map this standard measure of trade gains to the aggregate social welfare defined in section 3.1 since the latter can be written as  $W(\mathbf{p}) = N + \sum_{i \in \text{imp} \cup \text{exp}} W_i(p_i)$ . We calculate this for  $t = t^u$  and  $\tau = 0$  for the unconstrained case and  $\tau(\phi) + t^c$  for the constrained. We measure the welfare impact for an import  $i$  as  $(W_i^c - W_i^u)/W_i^u$  since the wage in  $W(\mathbf{p})$  is independent of commitment. The model assumes that the Turkish exporters' access to foreign markets to be independent of commitments in any *individual* import and so we hold export surplus constant in this calculation. Thus the *aggregate* gain of commitment (e.g. entering the EU customs union or signing GATT/WTO) should exceed  $\sum_{i \in \text{imp}} W_i(p_i)$  whenever Turkish exporters' market access increases. The functional form for  $\pi_i(p_i)$  was provided above. It is straightforward to derive per capita measures of surplus,  $s_i(p) = (B - p)^2/2b$ , and rents,  $(\tau(1 - \phi) + t)p^*(d_i(\cdot) - \pi'_i(\cdot)/N)$ .