

Choked by Red Tape?

The Political Economy of Wasteful Trade Barriers*

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May 16, 2019

Abstract

Red-tape barriers (RTBs) are an important source of trade costs, but have received little scholarly attention to date. Here we examine the economic-political determinants of RTBs and their effects on trade. Because of their wasteful nature, RTBs have very different implications from those of more traditional trade barriers. In particular, RTBs have important impacts on the extensive margin of trade, and respond in non-standard ways to changes in tariffs and natural trade costs. We argue that taking into account the endogenous response of RTBs is crucial for understanding the effects of tariff liberalization and globalization on trade and welfare.

Keywords: International trade policy; Non-tariff Measures; Political economy; Red tape barriers.

JEL Classification: F13, D7, F55

*We gratefully acknowledge comments from Marcelo Olarreaga, Bob Staiger and participants in seminars at GTDW (Geneva), Hong Kong University, Indiana University, Lancaster University, Nottingham University, Princeton, Vanderbilt, the World Bank and Yale, and in conferences at ANPEC, CEPR-PRONTO, CESifo, EEA, ERWIT, ETSG and RWEITA-Villars. Monika Mrázová thanks the Fondation de Famille Sandoz for funding under the “Sandoz Family Foundation - Monique de Meuron” Programme for Academic Promotion. Peter Neary thanks the European Research Council for funding under the European Union’s Seventh Framework Programme (FP7/2007-2013), ERC grant agreement no. 295669.

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1 Introduction

There is increasing evidence that “Red-Tape Barriers” (RTBs) – defined as policy-induced trade barriers that do not generate revenue or rents – are an important source of trade costs. Typically, RTBs take the form of procedural obstacles in the clearing of customs or in the application of non-tariff measures. According to the International Trade Center’s 2016 survey of EU exporters (ITC (2016)), the most common procedural obstacles are “time constraints,” which include delays in the clearing of customs or in the process of obtaining an import license or product certification, or short deadlines for submitting documentation. Other important procedural obstacles that often affect exporters are: administrative burdens related to regulations (such as a large number of required documents); information/transparency issues (e.g., information on the licensing/certification process is not adequately published and disseminated, or is inaccurate); and arbitrary behaviour of customs officials when handling the exporter’s application (ITC (2016), Table B6).¹

Also, governments may resort to less obvious ways to increase exporters’ trade costs: one example is given by India’s decision in 2015 to allow apple imports only via the Nhava Sheva port of Mumbai, while other ports such as Chennai were more efficient options for serving large parts of the country.² Similar measures have been used also by developed countries. A well-known example is given by France’s decision in 1982 to allow imports of Japanese video

¹Interestingly, when EU exporters are asked about the regulations they face in the importing country, they complain more about the procedural obstacles associated with the regulations than about the regulations themselves (ITC (2016), Table B5). One representative case is illustrated by a British exporter of lamb to Ghana, whose “company has to provide a Health Certificate issued by a vet. The certificate has to be immaculate, as even a small typo could result in the goods being rejected despite there being no threat to human life. There is no possibility to amend the error, and we are given two options: either destroy the goods or return them, both of which cost roughly the same.” (ITC (2016), page 9)

²There are strong indications that this was a deliberate protectionistic measure. Indian apple producers were suffering from increased apple imports and were lobbying the government for more protection, but tariffs on apples were already at the WTO bound level and therefore could not have been easily increased. According to the Indian Commerce and Industry Minister, Nirmala Sitharaman, “The government has received requests from several quarters, including public representatives, for increasing import duty on apples. The present import duty rates for apples is 50% which is also the bound rate of duty agreed to in GATT/WTO. As such, there is no scope for further increase in tariff rates without further negotiation under the WTO regime” (The Economic Times, August 3, 2016). Another newspaper commented: “The move was to protect the interests of the domestic producers who suffered on account of cheap imports from the US, China, Australia, New Zealand and Italy” (The Business Standard, October 24, 2015).

tape recorders only through the bottleneck of Poitiers, a small inland town, which resulted in the number of customs clearances falling from 100,000 per month to 8,000 per month.³

In spite of their growing importance, RTBs have largely been ignored by the academic literature. In this paper we take a first step toward understanding the economic-political determinants of RTBs and their effects on trade. We will show that the implications of RTBs are subtle and quite different from those of more traditional trade barriers.

Before we outline the model and our main results, it is useful to discuss briefly some empirical evidence about RTBs and their impact on trade.

There is an abundance of studies showing that RTBs are quantitatively important. For example, the 2012 WTO World Trade Report highlights that 76.5% of non-tariff measures entailed procedural obstacles, and the ITC (2016) survey points out that more than 90% of the reported product certifications were deemed problematic because of the procedural obstacles linked to the certification process. As another example, Djankov et al. (2010) estimate that 75% percent of the delays in shipping containers from origin to destination country are due to administrative hurdles, such as customs procedures, tax procedures, clearance and inspections.⁴

Perhaps surprisingly, RTBs are quite common in developed countries, although they are even more common in developing countries. This is clearly illustrated by the ITC (2016) survey (see pp. 19 and 40).⁵ Furthermore, RTBs often affect variable trade costs rather than fixed trade costs. This is particularly likely when RTBs cause delays in customs clearing (since delaying the entry of a big shipment imposes a bigger cost than delaying a small shipment) or when they cause a shipment to be rejected at the customs with a certain probability.⁶

³ The New York Times, November 22, 1982, “Essay; The Battle of Poitiers”.

⁴While in this paper we focus on RTBs that are imposed as a deliberate policy choice, RTBs may also be caused by technological limitations or resource constraints. We are not aware of systematic empirical studies that assess the relative importance of these two causes of RTBs, but there are many anecdotes suggesting that RTBs are often deliberate policy choices (see for example footnote 2). Also, one of the RTB indexes often considered in empirical studies (e.g. Beverelli et al. (2015) and Fontagné et al. (2016)) is the number of documents needed to export to a given market, which is more likely to be a policy choice than a technological constraint.

⁵An interesting example mentioned in ITC (2016) is that of a Germany-based wood products exporter, who reports: “Swiss Customs behave rather arbitrarily when dealing with the acceptance of the EUR.1 certificate. The processing time is always different and it is not possible to predict when the goods will reach the customer. It may take up to several weeks and as a result, the customer is displeased and suffers losses”.

⁶As an example of RTBs that affect variable costs by causing delays, “a small German company exporting musical instruments to India was not aware that a compulsory inspection takes place at the Indian Customs

Finally, RTBs are often prohibitive and have important impacts on the extensive margin of trade. A range of studies, including Dennis and Shepherd (2011), Nordås et al. (2006), Persson (2013), Hendy and Zaki (2013), Shepherd (2013), Beverelli et al. (2015) and Fontagné et al. (2016), examine the trade impact of various indexes of RTBs and find that they have a significant impact on the number of imported varieties. Also, calculations based on the large data sets in Kee et al. (2009) and Nicita et al. (2018) imply that a high proportion of non-tariff barriers are at or close to prohibitive levels.⁷

It might be tempting to attribute the extensive-margin effects of RTBs to Melitz-type selection effects induced by fixed costs, and some of the authors cited above suggest such a mechanism. However, studies of RTBs that use firm-level data cast doubt on this interpretation. Fontagné et al. (2016) find that larger firms are more affected by RTBs than smaller ones;⁸ and a similar finding is reported in Shepherd (2013). Also, Carballo et al. (2016) and ITC (2016, p. 17) find little difference in the impact of RTBs on small versus large firms. In this paper we suggest a different mechanism for the extensive-margin impact of RTBs, arising from a fundamental non-convexity in the government optimization problem.

Existing trade agreements, including the WTO, have gone a long way toward restraining the use of trade barriers across the world. However it is difficult for a trade agreement to rein in the use of RTBs, because it is hard to specify them *ex ante*, and it is hard to monitor and verify them *ex post*.⁹ This leads to a number of questions concerning the determinants of

due to lack of information. According to the company, ‘the inspection officials work slowly, causing the goods to be delayed for up to 105 days without any information about the status or outcome of the inspection.’ The company estimates the total cost of this measure to be 50% of the value of the product” (ITC (2016)).

⁷Comparing estimated ad-valorem equivalents of non-tariff barriers from Kee et al. (2009) with prohibitive tariff levels calculated by Nicita et al. (2018) shows that the share of products for which the ad-valorem equivalents are at least 90 percent of the prohibitive tariff is 28 percent in the US and 35 percent in the world. We thank Marcelo Olarreaga for these calculations.

⁸Fontagné et al. (2016) find that reducing by 10% the time and amount of documents needed to export into a market implies a 1% increase in the number of exported products for the average firm, and a 2.7% increase for large firms.

⁹Recently the WTO has made an important effort to reduce non-tariff trade costs through the “Trade Facilitation Agreement” (TFA). There are two main components to the TFA: encouraging investment in trade-related infrastructure (e.g. improving port efficiency), and reducing RTBs. Arguably, the latter objective is more challenging, especially if RTBs are used by governments as a disguised form of protectionism, and there is little evidence that the TFA has made a big difference in this respect thus far. On the other hand, deep-integration agreements like the EU can go a long way toward eliminating RTBs, especially if they remove customs borders between member countries (as the EU has done).

RTBs and their impacts on trade: How do equilibrium RTBs depend on the tariffs set by trade agreements? How do they respond to lobbying pressures? How are they affected by “natural” trade costs? How do equilibrium RTBs affect the intensive and extensive margins of trade? And how are the optimal cooperative tariffs affected by the anticipation that governments may resort to RTBs ex post?

To make our points more transparently, we assume a standard economic structure in the spirit of Grossman and Helpman (1994), and capture domestic lobbying pressures in a reduced-form way by assuming that governments attach extra weight to domestic producers in import-competing industries. We consider two types of trade policy: import tariffs and RTBs. Given that RTBs do not generate revenue, they are more inefficient than tariffs, so a government (even if politically motivated) would never use them if tariffs were unconstrained. But if a trade agreement constrains tariffs, RTBs may emerge.

We distinguish between an ex-ante stage, when the trade agreement is written, and an ex-post stage, when governments choose RTBs given the tariffs specified in the agreement. At the ex-ante stage, the political weights are uncertain. Importantly, the trade agreement is incomplete in two dimensions. First, the agreement can specify tariffs but not RTBs, so RTBs are left to a government’s discretion. Second, the tariffs specified in the agreement cannot be contingent on the level of political pressures in the various industries, so the agreement displays some rigidity.¹⁰

Our basic model focuses on a small country setting where the trade agreement is motivated by domestic-commitment issues, but later we consider a setting with two large countries where the agreement is motivated by terms-of-trade externalities, and show that our main insights extend to this setting.

We next preview our main results. We start by examining a government’s choice of RTBs taking tariffs as exogenous. The case of exogenous tariffs is interesting for several reasons. First, we can interpret the impact of parameter changes on RTBs as short-run effects, reflecting

¹⁰This view of trade agreements as incomplete contracts that can display both discretion and rigidity is similar in spirit to Horn et al. (2010).

the fact that tariffs cannot be renegotiated frequently. Second, exogenous tariff changes can be interpreted as tariff changes caused by shocks outside our model. And third, this case can capture situations where a country has little choice on the tariff commitments, for example because it must choose whether or not to join a pre-existing trade agreement.

In general there can be two sets of products. The first set consists of products for which import demand is convex or not very concave. For these products, given any tariff level the optimal RTB is either zero (if political pressures are weak) or prohibitive (if political pressures are strong); thus RTBs are likely to “choke” trade for a range of products, implying that the extensive margin is key for understanding the impact of RTBs.¹¹ The second set consists of products for which import demand is sufficiently concave, in which case the optimal RTB is non-prohibitive for a range of tariff levels and political pressures.

We consider two kinds of exogenous changes in trade costs: changes in tariffs and changes in “natural” (i.e. exogenous) trade costs. We will pay particular attention to the effects of an across-the-board reduction in tariffs, which we refer to as “tariff liberalization,” and an across-the-board reduction in natural trade costs, which we refer to as “globalization.”

We find that tariff liberalization can have surprising effects on trade, to the extent that it induces an increase in RTBs. Tariff liberalization leads to a (weak) contraction of trade at the extensive margin, because prohibitive RTBs can be triggered for a range of products.¹² Moreover, trade volume decreases for products covered by non-prohibitive RTBs, because for

¹¹This feature of our model is consistent with the above-mentioned empirical finding that RTBs have important impacts on the extensive margin of trade. As mentioned above, the most popular explanation for extensive-margin effects relies on fixed trade costs. Our model, on the other hand, can explain extensive-margin effects of RTBs without invoking fixed costs, but rather as a consequence of a non-convexity in the government optimization problem, due to the fact that consumer surplus and producer surplus are convex in prices.

¹²While we are not aware of evidence that tariff liberalization can lead to a strict reduction of trade at the extensive margin, our model suggests a possible interpretation of a couple of recent empirical findings. First, Feenstra and Ma (2014) find that tariffs and RTBs have significant effects at the extensive margin when they are both included as independent variables. And second, Debaere and Mostashari (2010) find that the overall effect of tariff reductions on the extensive margin is negligible (they do not observe RTBs); similar findings are reported in Feinberg and Keane (2009), although they only look at intra-firm and arms-length trade by MNCs. Taken together, these findings suggest that tariffs and RTBs *separately* affect the extensive margin, but the overall effect of tariff reductions on the extensive margin (including any induced RTB response) is negligible. Our model suggests a possible interpretation of these findings: non-cooperative tariffs are prohibitive for products with very strong political pressures, so tariff reductions *controlling for RTBs* may increase the number of imported products, but then this effect will be wiped out by the induced RTB response.

these products the government over-compensates for the tariff reduction with an increase in RTBs. Tariff liberalization has the intuitive trade-increasing effect only for products that are unencumbered by RTBs, which is the case if political pressures are sufficiently low.¹³

We then examine how RTBs depend on natural trade costs, holding tariffs fixed. We find that reducing natural trade costs for a given product *reduces* the probability that imports of that product are choked by RTBs; and at the aggregate level, globalization expands trade at the extensive margin. This seems surprising, because natural trade costs and RTBs in our model have identical economic effects, so one might expect them to be substitutes. Importantly, this counterintuitive effect of natural trade costs arises if and only if RTBs affect trade through the extensive margin; if RTBs are non-prohibitive, a reduction in natural trade costs has the intuitive effect of increasing RTBs. Thus the impact of natural trade costs on RTBs depends critically on whether RTBs operate at the extensive or the intensive margin.

The above results have important implications for studies aimed at evaluating the welfare gains from reducing tariffs or natural trade costs. Ignoring the possibility of RTBs will lead to *overstating* the welfare gains from tariff liberalization, but may well lead to *understating* the welfare gains from reductions in natural trade costs (globalization). Tariff reductions trigger policy substitution toward RTBs, so if the endogenous RTB response is ignored, the welfare gains from tariff liberalization will be overstated. In contrast, to the extent that RTBs operate at the extensive margin, reductions in natural trade costs mitigate a government's incentive to use RTBs, and hence if RTBs are ignored the welfare gains from globalization will be understated.

We then examine the optimal tariff commitments. We start with the benchmark case of no political uncertainty. In this case, the optimal tariff cuts *just* prevent RTBs from arising in equilibrium. But even if RTBs remain off-equilibrium, the potential for their use affects the extent of tariff liberalization: tariffs are set above the level that would be optimal if RTBs were unavailable, in order to avoid a “protectionist backlash” in the form of RTBs.

¹³The result that RTBs (when non-prohibitive) over-respond to tariff changes, so that tariff reductions have a perverse trade-reducing effect, contrasts with the policy-substitution effects highlighted in other papers, where typically the direct effect of the tariff reduction outweighs the indirect effect due to policy substitution toward non-tariff measures, so that trade increases as a result. See for example Copeland (1990) and Horn et al. (2010).

In the presence of political uncertainty, even if tariffs are optimized, RTBs arise in equilibrium for a range of products. Furthermore, the model suggests that increasing political uncertainty tends to increase the occurrence of RTBs in equilibrium.

We then examine how optimal tariffs are affected by a decrease in natural trade costs. Recall that, for the set of products where RTBs operate only at the extensive margin, globalization reduces the government’s incentive to use RTBs. Intuitively, then, globalization should reduce the need to keep tariffs high as a way to mitigate such incentive. We find that this intuition is correct if political uncertainty is sufficiently small, but if political uncertainty is large the result may be reversed. Furthermore, for the set of products such that RTBs can operate also through the intensive margin, globalization always increases the optimal tariffs (a reflection of the fact that for these products globalization increases the government’s incentive to use RTBs).

In the final part of the paper we extend the model in two directions: First we consider the case of partially wasteful trade barriers, meaning that only part of the revenue/rents associated with the policy is wasted. In this case, we find that our main results continue to hold, though with some interesting qualifications. Second, we consider the case of two large countries that sign a trade agreement to address terms-of-trade externalities. We show that the key qualitative results of the small-country case carry over to this environment.

In the related literature, several papers examine the substitutability between tariffs and non-tariff policies. Copeland (1990) and Horn et al. (2010) focus on production subsidies and consumption taxes. The implications of these policies are different from those of RTBs, in part because they generate revenue. Bagwell and Staiger (2001a) focus on domestic regulations and argue that, in the absence of uncertainty, an “outcome-based” contract that specifies minimum levels of market access is sufficient to achieve international efficiency. In this paper we focus instead on “instrument-based” contracts, in the same spirit as Horn et al. (2010), and make very different points from Bagwell and Staiger’s. See footnote 21 below for a discussion of outcome-based versus instrument-based agreements.¹⁴

¹⁴On the empirical side, papers that have found evidence of policy-substitution effects are for example Ray (1981), Ray and Marvel (1984), Kee et al. (2009), Bown and Tovar (2011), Limão and Tovar (2011), Eibl and Malik (2016) and Niu et al. (2018).

Another related paper is Beshkar and Lashkaripour (2016). They show that, if tariffs are not available, RTBs can be welfare-optimal for some sectors if they improve the terms of trade in other sectors. In contrast, our paper presents a political-economy theory of RTBs, where RTBs can be chosen even if they do not affect the terms of trade. As a consequence, our model can explain the use of RTBs also for small countries. Furthermore, while they focus on interdependencies across sectors, we focus on within-sector questions such as the impact of tariffs and natural trade costs on RTBs, the impacts on the extensive and intensive margins of trade, and the implications of RTBs for the tariffs specified in a trade agreement.¹⁵ Also related is Limão and Tovar (2011), who consider partially wasteful trade barriers. Their focus is very different from ours: they argue that a government may want to commit to lower tariffs to improve its bargaining position vis-à-vis domestic lobbies in the choice of non-tariff measures. Furthermore, they assume that the optimal level of the non-tariff barrier is always interior; but as we show in this paper, this assumption is unlikely to hold for RTBs, or more generally for policies with a large share of wasted revenue. Finally, Staiger (2012) focuses on trade facilitation agreements that encourage trade-cost-reducing investments. While we allow a government to freely increase trade costs above their “natural” levels, Staiger allows a government to decrease trade costs below their “natural” levels by making costly investments.

The paper is structured as follows. Section 2 lays out the basic model. Section 3 focuses on the case where RTBs affect only the extensive margin of trade. Section 4 considers the richer scenario where RTBs can also affect the intensive margin. Section 5 considers partially wasteful trade barriers. Section 6 considers terms-of-trade motivated trade agreements. Section 7 concludes. Proofs not given in the text are in the Appendix.

2 The Basic Model

In this section we lay out the basic model. We start by describing the political-economic environment, and then introduce trade agreements.

¹⁵Venables (1987) and Ossa (2011) also consider models where wasteful trade barriers can increase welfare, specifically because of firm-delocation effects under monopolistic competition.

2.1 The Political-Economic Environment

The setting is a small open economy that we call Home, trading with a large rest of the world, whose variables are denoted by an asterisk (*). Markets are perfectly competitive. The economy produces and consumes a continuum of products plus an outside good (which we take to be the numéraire).

In order to make our key points in the most transparent way, we assume quasi-linear and separable preferences.¹⁶ Each individual at Home has the following utility function:

$$U = x_0 + \int_i u_i(x_i) di \quad (1)$$

Given this utility function, the demand function for each of the nonnuméraire goods depends only on the good's own price: $x_i(p_i) = -s'_i(p_i)$, where $s_i(p_i) \equiv u_i(x_i(p_i)) - p_i x_i(p_i)$ is the surplus the consumer derives from good i . Integrating this over all goods i and adding individual income Y gives their indirect utility: $Y + \int_i s_i(p_i) di$.

On the supply side, each nonnuméraire good is produced using a specific factor and mobile labor with constant returns to scale. Aggregate supplies of all factors are fixed, equal to K_i for specific factor i and L for labor. The numéraire good uses only labor with constant returns to scale, and we assume that the labor supply is large enough that this good is always produced in equilibrium. Hence the wage is pinned down in the numéraire good sector. It is convenient to choose units of measurement such that both the wage and the aggregate supply of labor are equal to one (though it is sometimes more insightful to write L explicitly). The return to specific factor i is $\pi_i = r_i K_i$. Given the technology assumed, π_i depends only on p_i , so we denote it $\pi_i(p_i)$. By Hotelling's Lemma, the supply of each good is given by the derivative of the profit function: $y_i(p_i) = \pi'_i(p_i)$. Hence total factor income equals $L + \int_i \pi_i(p_i) di$.

Since we want to focus on import barriers, it is convenient to assume that (supply and demand parameters are such that) all nonnuméraire goods are imported while the numéraire

¹⁶Allowing for substitutability across goods complicates the analysis without adding much insight. In an alternative version of our model where individuals have Melitz-Ottaviano preferences, it can be shown that our qualitative results remain unchanged.

good is exported.¹⁷ We will focus on specific tariffs τ_i , so the revenue from a tariff is $\tau_i m_i(p_i)$, where $m_i(p_i) = x_i(p_i) - y_i(p_i)$. Tariff revenue is rebated to citizens in a non-distortionary way, but the government cannot make targeted lump-sum transfers to specific groups.

Welfare is defined as aggregate indirect utility. Letting $\bar{Y} = L + \int_i \pi_i(p_i) di + \int_i \tau_i m_i(p_i) di$ denote aggregate income, we can write welfare as $\bar{W} = \bar{Y} + \int_i s_i(p_i) di$, or equivalently:

$$\bar{W} = L + \int_i W_i di \quad \text{where:} \quad W_i \equiv s_i(p_i) + \pi_i(p_i) + \tau_i m_i(p_i) \quad (2)$$

In addition to the tariffs, there are two types of trade costs: red-tape barriers (RTBs), which are denoted θ_i , and “natural” (exogenous) trade costs δ_i . For the present, we assume that RTBs generate no revenue or rents; in Section 5 we will allow them to generate some rents. The natural trade costs δ_i are unaffected by trade policy but can be interpreted as determined by factors such as technology and geography. RTBs and natural trade costs contribute to the wedge between domestic price and world price, so we can write the domestic price of good i as:

$$p_i = p_i^* + \delta_i + \tau_i + \theta_i \quad (3)$$

We now introduce the government’s objective function. To capture the idea that the government chooses trade policy subject to domestic political pressures, we assume that the government maximizes the following politically-adjusted welfare function:

$$\bar{V} = L + \int_i V_i di \quad \text{where:} \quad V_i \equiv s_i(p_i) + (1 + \gamma_i) \pi_i(p_i) + \tau_i m_i(p_i) \quad (4)$$

The weight $\gamma_i > 0$ reflects the political influence of domestic producers of good i . This type of reduced-form government objective is similar to Hillman (1982) and Baldwin (1987), and can be “micro-founded” along the lines of Grossman and Helpman (1994).¹⁸

¹⁷This assumption *per se* is not restrictive, because the numéraire good can be interpreted as a composite of all exported goods, since we assume no export policies and we fix all prices of these goods.

¹⁸We assume that tariffs and RTBs are chosen by a unitary government, but an alternative interpretation of the same setting is that RTBs are under the control of low-level bureaucrats, e.g. customs officials, who have a different objective than the central government. Suppose that customs officials can “sell” RTBs to local

Note that the structure we have laid out is separable across products. Nevertheless it is instructive to consider a setting with many imported products, rather than a single one, because this allows us to examine how the extensive and intensive margins of trade are affected by changes such as general reductions in tariffs and natural trade costs.

Before we consider trade agreements, it is useful to examine the benchmark case of noncooperative policy choice, that is the case in which the home government can choose tariffs and RTBs to maximize its politically-motivated objective without any constraints.

Given separability across products, we can focus on a single imported product i . Both the tariff and the RTB protect home firms, but only the tariff raises revenue. Hence, in the absence of any constraints on its use of the tariff, the government will never use the RTB. Assuming that V_i is concave in τ_i , the optimal noncooperative tariff τ_i^N is defined by the following first-order condition:

$$\frac{dV_i}{d\tau_i} = \gamma_i y_i + \tau_i m'_i = 0 \tag{5}$$

This yields $\tau_i^N = -\frac{\gamma_i y_i}{m'_i}$. We note that the optimal tariff is prohibitive if γ_i is above some threshold level, which we label γ_i^H .¹⁹

2.2 Trade Agreements

We are now ready to introduce trade agreements in our model. We distinguish between an ex-ante stage in which the Home government can sign a trade agreement, and an ex-post stage in which the government chooses trade policies subject to the constraints imposed by the trade agreement.

producers (in the spirit of Grossman and Helpman’s “protection for sale”), and their objective is to maximize the bribes they receive. If we think of the relationship between the central government and customs officials as a principal-agent relationship, and we abstract from informational frictions, then RTBs will maximize the joint surplus of principal and agent, which in this setting boils down to a weighted average of consumer surplus, producer surplus and revenue. We also note that, since our basic model assumes that RTBs generate no revenue, it does not capture situations where customs officials can extract bribes *from exporters*, because such bribes are a form of revenue. However, if the government attaches less weight to such bribes than to the other components of welfare, this scenario fits in our extension of Section 5, where we consider non-tariff barriers with partial waste of revenue.

¹⁹Note that if γ_i is slightly above γ_i^H then the optimal tariff is prohibitive but V_i is still concave in τ_i , while if γ_i is much higher than γ_i^H then V_i is convex in τ_i and the optimal tariff is *a fortiori* prohibitive.

We assume that the political weights γ_i are observed ex post but uncertain ex ante. Ex ante, each γ_i is distributed according to some cumulative distribution function $G_i(\gamma_i)$, with associated density function $g_i(\gamma_i)$. We assume that $g_i(\gamma_i)$ is continuous with support $[\gamma_i^{min}, \gamma_i^{max}]$. The political weights are assumed to be independent across products. All other parameters of the model are assumed to be deterministic.

As mentioned in the introduction, we view trade agreements as contracts that are incomplete in two dimensions. First, a trade agreement can specify tariffs but not RTBs, reflecting the difficulties of verifying RTBs ex-post and of describing them in detail ex ante. This means that the agreement leaves *discretion* over RTBs. Note that, since RTBs are not covered by the agreement, they can respond flexibly to political pressures ex post.

Second, the agreement cannot specify contingent tariffs. In our setting, the relevant contingencies are the political shocks γ_i , so we are assuming that tariffs cannot be made contingent on political shocks (while they can be tailored to all other product characteristics).²⁰ This means that the agreement also displays some *rigidity*.²¹ As will become clear, in our model the co-existence of rigidity and discretion in the trade agreement is responsible for the emergence of RTBs in equilibrium.

We will examine the implications of a trade agreement in two steps. First we will take tariff commitments as exogenous, and highlight the implications of tariff reductions for the use of

²⁰As an alternative to this assumption, we could have assumed that each good i is differentiated along some dimension (e.g. quality) and the tariff on each good i must be uniform.

²¹Horn et al. (2010) develop a model that explains rigidity and discretion in trade agreements as arising endogenously from contracting costs. As discussed in that paper, there may exist ways to mitigate the issues of rigidity and discretion in trade agreements. For example, one way to mitigate the rigidity of tariff commitments is to use tariff caps instead of exact tariff commitments (see also Amador and Bagwell (2013)). Tariff caps allow downward flexibility in the choice of tariffs. Such flexibility can improve efficiency in some states of the world, but it cannot completely eliminate the inefficiency from rigidity. As we discuss later in the paper, our main results are qualitatively unchanged when we consider tariff caps instead of exact tariff commitments. There may also be ways to mitigate the problem of discretion over non-tariff policies: for example, the agreement could be structured as an “outcome-based” contract whereby the importing country guarantees a minimum volume of imports. Arguably, the GATT’s so-called “non-violation” clause (Article XXIII:1(b)) falls in this broad category of rules. An important limitation of an outcome-based contract however is that, if there are demand or supply shocks that affect trade volume, the contract needs to be fully contingent on these demand and supply shocks, and this may be very difficult or not even feasible. Just as in Horn et al. (2010), in this paper we focus on “instrument-based” contracts rather than outcome-based contracts. A formal examination of the tradeoffs between these two types of contracts in a more general stochastic setting would be a worthwhile endeavor, but one that is beyond the scope of this paper.

RTBs, as well as the impact of some key parameter changes (in particular, a decline in natural trade costs) when tariffs are held fixed.²²

The second step will be to consider explicitly the formation of a trade agreement and examine the optimal tariff commitments. In the basic model we consider a domestic-commitment motivated trade agreement, focusing on a small country, but in Section 6 we will consider also the case of a terms-of-trade motivated trade agreement between two large countries. We capture domestic-commitment motives in a very stylized way, by assuming that the government’s ex-ante objective is different from its ex-post objective. In particular, ex ante the government maximizes social welfare (given by (2)), but when choosing trade policies ex post it maximizes the politically-adjusted social welfare function (given by (4)).²³ One interpretation of this reduced-form setting is that, when the agreement is signed, the government is in “constitution-writing” mode, and would like to prevent future policy-makers from engaging in protectionism. Alternatively, this setting could capture a government that faces time-consistency issues and would like to prevent its future self from caving in to domestic political pressures. This reduced-form approach can be given micro-foundations, for example, along the lines of Maggi and Rodríguez-Clare (1998) or Mitra (2002).

3 RTBs and the Extensive Margin of Trade

We are now ready to launch into the analysis of our basic model. In this section we focus on the case where RTBs affect only the extensive margin of trade, whereas in Section 4 we will consider the more general setting where RTBs can also affect the intensive margin.

²²As we mentioned in the Introduction, there are three reasons to consider the exogenous-tariff scenario: this can be interpreted either as a short-run scenario, or as a situation where tariff changes are caused by shocks outside our model, or as a situation where a country must choose whether or not to join a pre-existing trade agreement.

²³Our qualitative results would not change if we allowed for political pressures also at the ex-ante stage, as long as they are less strong than at the ex-post stage.

3.1 Exogenous Tariff Commitments

In this subsection we examine the government's ex-post choice of RTBs given an exogenous set of tariff commitments.

As a preliminary step, it is instructive to focus on the benchmark case where RTBs are the only instruments available, for example because a trade agreement sets the tariffs at zero. In this case, we ask, when will the government impose RTBs?

Recall that, given the separability of our structure, we can focus on a single product. The key observation here is that if $\tau_i = 0$ then V_i is convex in θ_i , because both consumer and producer surplus are convex in p_i :

$$(i) \frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i \quad (ii) \frac{d^2V_i}{d\theta_i^2} = \gamma_i y'_i - m'_i > 0 \quad (6)$$

This implies a corner solution: the optimal θ_i is either zero or prohibitive. Let V_i^{FT} denote the value of V_i when evaluated at free trade and V_i^{NT} (for “non traded”) its value when evaluated at prohibitive trade costs. The optimal RTB is prohibitive if and only if $V_i^{NT} > V_i^{FT}$. This is the case if the political weight γ_i exceeds a threshold level:

$$V_i^{NT} > V_i^{FT} \quad \Leftrightarrow \quad \gamma_i > \gamma_i^L \equiv \frac{s_i^{FT} - s_i^{NT}}{\pi_i^{NT} - \pi_i^{FT}} - 1 \quad (7)$$

The condition in (7) means that γ_i is high enough that the gain in producer surplus when moving from free trade to no trade is valued more highly than the loss in consumer surplus. It is easy to show that $\gamma_i^L < \gamma_i^H$. To rule out uninteresting cases, we assume that there is a non-empty intersection between the support of γ_i and the interval (γ_i^L, γ_i^H) .

The benchmark case in which tariffs are not available illustrates a simple but fundamental feature of the government's unilateral choice of wasteful trade barriers: it may be optimal to use such barriers if more efficient trade policies are not available, but then the government's objective function is not concave, due to the absence of revenue. This non-concavity will play a key role in what follows, and indeed will be the driver of the extensive-margin effects of RTBs

in our model.

We are now ready to examine the government's ex-post choice of RTBs given arbitrary tariff commitments. Suppose that the tariff for product i is constrained at some level $\tau_i < \tau_i^N$, and consider the ex-post choice of θ_i given this tariff. A key determinant of such ex-post choice is whether V_i is concave or convex in θ_i . Relative to the previous case of zero tariffs, an increase in the RTB now has an additional effect: increasing θ_i lowers tariff revenue. Because of this effect, V_i may be concave for a range of τ_i if import demand m_i is sufficiently concave. To see this, differentiate (4) with respect to θ_i , allowing for a positive tariff:

$$(i) \frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i + \tau_i m_i' \quad (ii) \frac{d^2V_i}{d\theta_i^2} = \gamma_i y_i' - m_i' + \tau_i m_i'' \quad (8)$$

As the expressions above indicate, if import demand m_i is convex or slightly concave then V_i is convex in θ_i for all τ_i , but if m_i is sufficiently concave then V_i is concave in θ_i for $\tau_i > 0$.

To make some key points in the simplest way, in this section we assume that, for all products, V_i is convex in θ_i for all τ_i , deferring the more general case until Section 4.

If V_i is convex, the ex-post choice of θ_i exhibits a bang-bang pattern: it is either zero or prohibitive, depending on the realized political weight and the tariff. We let $\theta_i^R(\gamma_i, \tau_i)$ denote the ex-post choice of θ_i as a function of γ_i and τ_i . We call this the "RTB response function." Here and throughout the analysis, in order to avoid cluttering the notation, we omit the argument δ_i from the RTB response function and all other functions, even though this will be a key parameter of interest.

It is immediate to show that there exists a threshold $\gamma_i^J(\tau_i)$ such that the RTB response is prohibitive for $\gamma_i > \gamma_i^J(\tau_i)$ and zero for $\gamma_i \leq \gamma_i^J(\tau_i)$.²⁴ Figure 1 illustrates this result, and Remark 1 states it formally.

Remark 1. *Given $\tau_i < \tau_i^N$, there exists a threshold $\gamma_i^J(\tau_i)$ such that $\theta_i^R(\gamma_i, \tau_i)$ is prohibitive if $\gamma_i > \gamma_i^J(\tau_i)$ and zero if $\gamma_i \leq \gamma_i^J(\tau_i)$. Thus RTBs operate only at the extensive margin of trade, as they affect only the number of imported products.*

²⁴We assume that in case of indifference the government chooses $\theta_i = 0$.

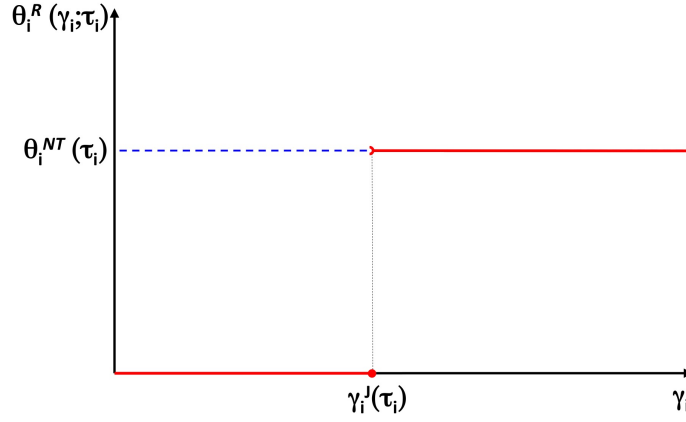


Figure 1: RTB Response as a Function of γ_i : Bang-Bang Case

Remark 1 is intuitive, given that the optimal θ_i must be at a corner: holding the tariff fixed, imports of product i will be choked by RTBs if the realized political weight for this product is high, while RTBs will not be used at all if the realized political weight is low. The prediction that RTBs have important impacts on the extensive margin of trade seems consistent with the available empirical evidence on the effects of RTBs (see our discussion in the Introduction).

Next we turn to the impact of tariffs on RTBs. It is intuitive and easy to show that the threshold $\gamma_i^J(\tau_i)$ is increasing in τ_i . As a consequence, it is clear that lowering τ_i increases the probability that imports of product i will be choked by red tape.

Consider next the impact of a general decrease in tariffs across all products. Let F^{choke} denote the fraction of products whose imports are choked by red tape. An immediate implication of the observation above is that, if τ_i falls for all products, $Pr(F^{choke} < x)$ decreases weakly for any x , therefore F^{choke} increases in the first-order stochastic sense. The following proposition summarizes the impact of tariff reductions on RTBs at the product level and at the aggregate level:

Proposition 1. (i) *The probability that imports of product i are choked by RTBs increases (weakly) as τ_i falls;* (ii) *If τ_i falls for all products, F^{choke} increases (weakly) in the first-order stochastic sense.*

Proposition 1 reflects a kind of “policy substitution” effect: when tariffs are lower, the government has more incentive to use RTBs. The novel aspect of this substitution effect is that it

occurs at the extensive margin.²⁵

We next examine the effect of tariff liberalization on *trade* when we take into account both the direct effect of the tariff changes and the induced RTB response. As a direct consequence of the tariff reductions, trade increases at the intensive margin, because conditional on a product being imported the tariff reduction does not trigger the use of RTBs; but trade shrinks at the extensive margin, because the fraction of products whose imports are choked by RTBs increases.

Corollary 1. *The joint effect of tariff liberalization and the induced RTB response is a (weak) increase of trade at the intensive margin and a (weak) contraction of trade at the extensive margin.*

Corollary 1 highlights an interesting decoupling of the intensive-margin and extensive-margin effects of tariff liberalization: while the intensive-margin effect goes in the intuitive direction, the extensive-margin effect can go in the opposite direction because of the induced RTB response.

It is worth noting that, if the non-cooperative tariff level for a given product is prohibitive (recall this is the case if $\gamma_i > \gamma_i^H$) and the tariff is reduced below the prohibitive level, the response will be a prohibitive RTB, so trade volume for that product will remain at zero.²⁶

Next we focus on the impact of natural trade costs on RTBs. In light of the substitutability between tariffs and RTBs, one might think that a reduction in natural trade costs should increase the government's temptation to impose RTBs. Indeed, natural trade costs and red-tape barriers enter the government's objective function only through their sum $\delta_i + \theta_i$, suggesting that δ_i and θ_i should be even more closely substitutable than τ_i and θ_i . However, this intuition turns out not to be correct.

The key point is that, for each product, the threshold political weight γ_i^J increases as δ_i decreases. To see why, consider a configuration of parameters such that the government is

²⁵Policy-substitution effects have been highlighted at the theoretical level for other non-tariff measures, but not at the extensive margin (see e.g. Copeland (1990), Horn et al. (2010) and Limão and Tovar (2011)).

²⁶As we mentioned in the Introduction (note 12), this result suggests a possible interpretation of the findings in Feenstra and Ma (2014) and Debaere and Mostashari (2010) that both tariffs and RTBs separately affect the extensive margin, but the overall effect of tariff reductions on the extensive margin is negligible: according to our model, tariff reductions may increase trade at the extensive margin holding RTBs constant, but this effect will be wiped out by the induced RTB response.

indifferent between $\theta_i = 0$ and a prohibitive value of θ_i . Since V_i is convex in θ_i and takes the same value at the two extremes of θ_i , it follows that V_i is U-shaped in θ_i , and thus a small increase in θ_i from zero reduces V_i . But an increase in δ_i has the same effect as an increase in θ_i , and has no impact on the no-trade payoff level, V_i^{NT} . Hence a rise in δ_i favors the prohibitive level of the RTB over the zero level. Figure 2 visualizes this point.

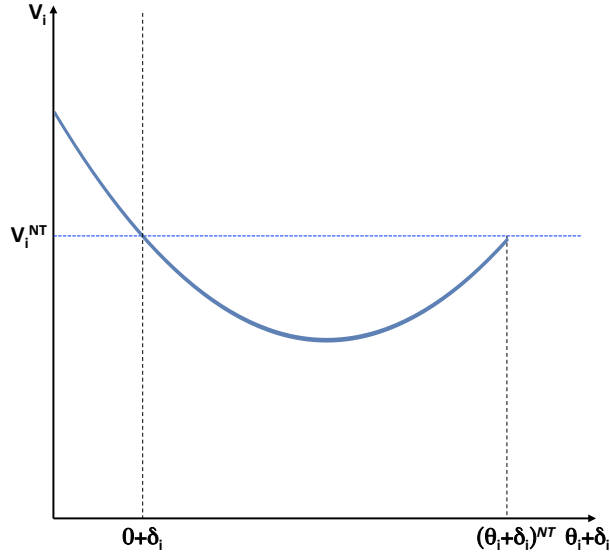


Figure 2: RTBs and Natural Trade Costs

An alternative perspective to understand this result is to consider the cross derivative of V_i with respect to θ_i and δ_i . Clearly, this cross derivative is equal to the second derivative of V_i with respect to θ_i , which in this setting is positive. Thus, when the objective function is convex in θ_i , so that the optimum is at a corner, θ_i is complementary to δ_i .

Consider next the impact of a general fall in natural trade costs (globalization). Applying a similar aggregation logic as the one we used above for tariffs, it is easy to argue that, if δ_i falls for all products, F^{choke} must decrease in the first-order stochastic sense, and therefore trade expands at the extensive margin. We can thus state:

Proposition 2. *Holding tariffs constant: (i) The probability that imports of product i are choked by red tape is increasing in the natural trade cost δ_i . (ii) Globalization implies a reduction of F^{choke} in the first-order stochastic sense.*

Proposition 2(i) suggests a cross-sectional prediction of the model: products characterized by

lower natural trade costs are less likely to be hit by RTBs.²⁷ Proposition 2(ii) suggests a “time-series” prediction of the model: holding tariffs fixed, globalization should lead to fewer RTBs, and through this channel, to an expansion of trade at the extensive margin (in addition to the direct positive effect on the intensive margin).

Before proceeding, we note an important implication of the results presented above. If one evaluates the welfare gains from a reduction in tariffs or a reduction in natural trade costs (globalization) ignoring the possibility of RTBs, one will *overstate* the welfare gains from tariff liberalization, but *understate* the welfare gains from globalization. Tariff reductions trigger policy substitution toward RTBs, so it is obvious that if the endogenous RTB response is ignored, the welfare gains from tariff liberalization will be overstated. But the sign of this “bias” is reversed when evaluating the welfare effects of globalization, because reductions in natural trade costs reduce a government’s incentive to use RTBs.

3.2 Optimal Tariff Commitments

In this subsection we examine the optimal choice of tariff commitments. The agreement is chosen *ex ante* to maximize the Home country’s welfare, taking into account that *ex post* the government will be subject to political pressures. Recall that the agreement can only specify tariffs, and that the tariffs cannot be contingent on the political shocks (γ_i).

It is instructive to start with the benchmark case in which there is no political uncertainty, in the sense that the distribution of each γ_i is degenerate at some value γ_i^0 . In this case each tariff can be tailored to the political weight of a product (as well as to the other product characteristics), so there is no rigidity in the tariffs. For this reason we call the optimal tariffs in this scenario the “bespoke” tariffs, and denote them by $\tau_i^B(\gamma_i^0)$.

Given the separability of our structure, we can optimize the tariff product by product.

²⁷This suggests a possible explanation for why RTBs are more common in developing countries: exogenous trade costs are in part determined by technology and thus are likely to be higher for less advanced countries.

Focusing on product i , the optimization problem can be written as follows:

$$\tau_i^B(\gamma_i^0) \equiv \arg \max_{\tau_i} W_i(\tau_i, \theta_i^R(\gamma_i^0, \tau_i)), \quad \text{where} \quad \theta_i^R(\gamma_i^0, \tau_i) \equiv \arg \max_{\theta_i} V_i(\tau_i, \theta_i, \gamma_i^0) \quad (9)$$

Recall from Proposition 1 that $\theta_i^R(\gamma_i^0, \tau_i)$ is prohibitive if and only if $\gamma_i^0 > \gamma_i^J(\tau_i)$, where $\gamma_i^J(\tau_i)$ is increasing in τ_i . It follows immediately that θ_i^R is prohibitive if and only if $\tau_i < \tau_i^J(\gamma_i^0)$, where $\tau_i^J(\cdot)$ is the inverse of $\gamma_i^J(\cdot)$. Intuitively, then, the bespoke tariff $\tau_i^B(\gamma_i^0)$ is the lowest tariff that does not trigger RTBs, hence it coincides with $\tau_i^J(\gamma_i^0)$.²⁸ Figure 3 illustrates the bespoke tariff for product i . For all tariffs below $\tau_i^J(\gamma_i^0)$ a prohibitive RTB is triggered, thus yielding the no-trade level of welfare W_i^{NT} ; if the tariff is raised slightly above $\tau_i^J(\gamma_i^0)$ the RTB response jumps down to zero, so the welfare level jumps up, and then falls as the tariff increases further. It follows that the bespoke tariff is $\tau_i^J(\gamma_i^0)$.

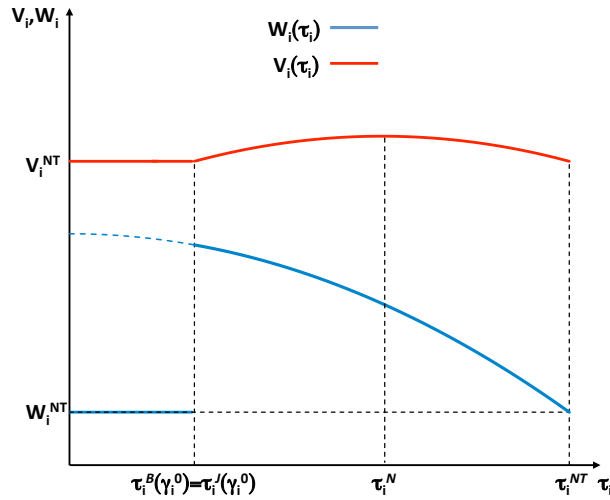


Figure 3: The Bespoke Tariff

Next we ask how the bespoke tariff varies with the natural trade cost δ_i . Recall from the discussion after Proposition 2 that decreasing δ_i reduces the incentive to impose RTBs. There we showed that, given the tariff, the threshold political weight γ_i^J is decreasing in δ_i . With the same logic it is easy to show that the threshold tariff $\tau_i^J(\gamma_i^0)$ – and hence the bespoke tariff $\tau_i^B(\gamma_i^0)$ – goes down as δ_i decreases. Summarizing our results for the bespoke tariff:

²⁸Recall the assumption that, in case of indifference, the government chooses $\theta_i = 0$. If instead it chooses $\theta_i = 0$ with probability less than one, then the optimal tariff will be “just” above $\tau_i^J(\gamma_i^0)$.

Remark 2. *If the distribution of γ_i is degenerate at γ_i^0 (so there is no rigidity in the tariff commitment), then: (i) the optimal tariff for product i is the lowest tariff that does not trigger choking by red tape; (ii) the optimal tariff is increasing in the natural trade cost δ_i .*

The intuition for Remark 2(i) is simple: a complete trade agreement would specify zero trade barriers in this small open economy, but given that the agreement cannot specify RTBs, the optimal (incomplete) agreement sets a tariff which is just high enough to avoid a “protectionist backlash” that would choke imports. Note that, in this benchmark case where tariffs are fully contingent, no RTBs emerge in equilibrium. However, the *potential* for use of RTBs limits the extent of tariff liberalization: if RTBs were not available the optimal agreement would lower tariffs all the way to zero, but given that RTBs are available, the optimal agreement sets strictly positive tariffs to prevent RTBs from emerging.²⁹

Remark 2(ii) states that, in this scenario, optimal tariffs are lower when natural trade costs are lower. Intuitively, if natural trade costs are lower the government is less tempted to use RTBs for given tariffs, so there is less need to keep tariffs high.

Now we introduce political uncertainty, by considering a non-degenerate distribution of γ_i for each i . The optimal tariff, denoted $\bar{\tau}_i$, maximizes expected welfare for product i :

$$\bar{\tau}_i \equiv \arg \max_{\tau_i} \int_{\gamma_i^{\min}}^{\gamma_i^{\max}} W_i(\tau_i, \theta_i^R(\gamma_i, \tau_i)) dG_i(\gamma_i) \quad (10)$$

We assume that expected welfare is concave in τ_i . Given the bang-bang nature of the RTB response function, we can re-write expected welfare from (10) as:

$$\int_{\gamma_i^{\min}}^{\gamma_i^J(\tau_i)} W_i(\tau_i, 0) dG_i(\gamma_i) + \int_{\gamma_i^J(\tau_i)}^{\gamma_i^{\max}} W_i^{NT} dG_i(\gamma_i) = G_i(\gamma_i^J(\tau_i)) W_i(\tau_i) + [1 - G_i(\gamma_i^J(\tau_i))] W_i^{NT} \quad (11)$$

where we adopt the convention $\int_a^b f(x) dx = 0$ if $a > b$. When $\gamma_i < \gamma_i^J(\tau_i)$ the product is imported at the tariff τ_i , but when $\gamma_i > \gamma_i^J(\tau_i)$ imports of product i are choked by red tape,

²⁹This effect is reminiscent of the “indirect incentive-management” effect in Horn et al. (2010), where tariffs need to be kept relatively high to mitigate the incentive of governments to use production subsidies, if these are not specified in the agreement.

yielding the no-trade welfare level. The first-order condition (FOC) for the optimal tariff is:

$$g_i(\gamma_i^J(\tau_i)) \frac{d\gamma_i^J(\tau_i)}{d\tau_i} \Delta W_i(\tau_i) + G_i(\gamma_i^J(\tau_i)) \frac{\partial W_i(\tau_i, 0)}{\partial \tau_i} = 0 \quad (12)$$

where $\Delta W_i(\tau_i) \equiv W_i(\tau_i, 0) - W_i^{NT}$ is the welfare loss caused by a prohibitive RTB relative to a zero RTB (for a given tariff).

The FOC above highlights the tradeoffs involved in the optimal choice of tariff. An increase in the tariff has two distinct effects on welfare. The first term is positive and is due to the fact that raising the tariff reduces the range of γ_i for which imports are choked by red tape, by increasing the threshold γ_i^J and hence generating a discrete welfare gain ΔW_i for values of γ_i close to γ_i^J . The second term in (12), on the other hand, is negative and reflects the adverse “infra-marginal” welfare effects of increasing the tariff for the range of γ_i such that red-tape barriers are not imposed.

We next argue that, when tariffs are optimized, RTBs are more likely to arise when political uncertainty is larger.

Let γ_i^{med} denote the median value of γ_i . Consider the left-hand side of (12) evaluated at $\tau_i^J(\gamma_i^{med})$. Recall that the first term is positive and the second term is negative. Note that $\gamma_i^J(\tau_i^J(\gamma_i^{med})) = \gamma_i^{med}$ and $G_i(\gamma_i^{med}) = 1/2$. Thus, if we reduce the density of γ_i at the median, $g_i(\gamma_i^{med})$, the second term evaluated at $\tau_i^J(\gamma_i^{med})$ does not change. Next focus on the first term. If $g_i(\gamma_i^{med})$ is close to zero, the left-hand side of (12) is negative, and hence the optimal tariff is below $\tau_i^J(\gamma_i^{med})$. On the other hand, if $g_i(\gamma_i^{med})$ is high enough, the first term outweighs the second term and hence the left-hand side of (12) is positive, thus the optimal tariff is above $\tau_i^J(\gamma_i^{med})$. Next note that $\tau_i > \tau_i^J(\gamma_i^{med})$ is equivalent to $\gamma_i^J(\tau_i) > \gamma_i^{med}$, or equivalently, product i is choked by red tape with probability lower than 1/2. This is the basic logic behind the following result:

Remark 3. *There exists a threshold \bar{g} such that the probability that imports of product i are choked by red tape is lower than 1/2 if $g_i(\gamma_i^{med}) > \bar{g}$ and higher than 1/2 if $g_i(\gamma_i^{med}) < \bar{g}$.*

To interpret this result notice that, for the most common parametric distributions, including

Pareto, normal, lognormal, and uniform, it is easy to show that lowering the density at the median ($g_i(\gamma_i^{med})$) is equivalent to a mean-preserving spread. Recall also from Remark 2(i) that, if there is no uncertainty at all, no RTBs arise under the optimal tariff. The above result thus suggests that RTBs should be more likely to arise for products characterized by larger political uncertainty. The intuition behind this result is simple: the “ideal” level of the tariff commitment is the one that just prevents RTBs from arising, but since tariffs cannot be contingent on political shocks, increasing political uncertainty causes “errors” and induces RTBs in equilibrium.

Next we focus on the impact of natural trade costs on the optimal tariff commitments. First note that, if political uncertainty is sufficiently small, in the sense that the distribution of γ_i is sufficiently concentrated, the optimal tariff is increasing in δ_i . This follows from Remark 2(ii), where we showed that, if the distribution of γ_i is degenerate, the optimal tariff is increasing in δ_i . By continuity, this is true also if the distribution of γ_i is very concentrated. The intuition for this result is that a reduction in natural trade costs reduces a government’s incentive to use RTBs, and hence there is less need to keep tariffs high to keep this incentive in check. However, this result may be reversed if political uncertainty is large enough. A fall in δ_i affects the first-order condition (12) through multiple channels, so it is easy to see why in general the overall effect can go in either direction. In particular, one of these effects is that reducing δ_i increases ΔW_i , the welfare loss from choking trade; this effect pushes in favor of a higher tariff. For example, if demand is linear, supply is fixed and the distribution of γ_i is either Pareto or uniform, we find that the optimal tariff is increasing in δ_i when dispersion is sufficiently large. In the Appendix we prove:

Proposition 3. *If political uncertainty is sufficiently small, a fall in δ_i reduces the optimal tariff. However, this effect may be reversed if political uncertainty is sufficiently large.*

Before concluding this section, we note that our main results would not be affected if the agreement specified tariff caps instead of exact tariff commitments (see also footnote 21). One can show that the optimal tariff cap is higher than the optimal exact tariff commitment, because

the downward flexibility associated with tariff caps reduces the marginal cost of raising the tariff level, but our results are not altered in a qualitative way.³⁰

4 RTBs and the Two Margins of Trade

In the previous section we focused on the case in which equilibrium RTBs affect only the extensive margin of trade. However, in more general settings RTBs can also operate at the intensive margin. One such case, to be explored in this section, is where we allow for general demand and supply functions, so that RTBs may be non-prohibitive for a subset of goods. Section 5 provides a different explanation for interior solutions: with partial rent retention they can arise for any specification of demand.

Recall from equation (8) that for product i , given a positive tariff, if import demand is sufficiently concave the government objective V_i is concave.³¹ In this case, the RTB response $\theta_i^R(\gamma_i, \tau_i)$ may be non-prohibitive for a range of γ_i and τ_i . In this section we generalize the analysis of the model to allow for this possibility. As in the previous section, we start by focusing on the case of exogenous tariff commitments.

4.1 Exogenous Tariff Commitments

Let us start by focusing on a given product i . Fix the tariff τ_i and consider how the optimal RTB depends on the realization of the political weight γ_i . Clearly θ_i^R can be non-prohibitive only for

³⁰The main change would be that the government can choose both θ_i and τ_i subject to the tariff cap. In general there will be a low interval of γ_i such that the tariff cap is not binding, in which case the government chooses the optimal noncooperative tariff and $\theta_i = 0$. Clearly this does not affect the bang-bang nature of the RTB response function, with a threshold level of γ_i such that θ_i is zero below it and prohibitive above it. When it comes to the optimal tariff cap, there would be one additional term in the first-order condition (12), corresponding to the range of γ_i where the tariff cap is not binding, but our results would still go through.

³¹Most commonly-used structures impose convexity, at least weakly. However, this is an assumption that is rarely tested. An exception is Mrázová and Neary (2017), who use estimates of pass-through and markups from De Loecker et al. (2016) to back out the combinations of demand elasticity and convexity implied by the data, and discuss which demand specifications are consistent with them. (See Section IV.A, especially Figures 10 and 11.) The evidence convincingly rejects the widely-used CES specification, but does not reject highly concave demand, well within the range needed for the results in this section on interior RTBs. A specific example where $\theta_i^R(\gamma_i, \tau_i)$ is non-prohibitive for a range of γ_i and τ_i is the case in which supply is fixed and the demand function takes the Pollak (1971) form, that is $x_i(p_i) = \alpha_i - \beta_i p_i^{\sigma_i}$, with $\sigma_i > 2$.

an intermediate interval of γ_i , because θ_i^R must be zero if γ_i is close to zero and prohibitive if γ_i is sufficiently high. It is also intuitive that, within the non-prohibitive interval, θ_i^R is increasing in γ_i . In what follows we let $\hat{\gamma}_i(\tau_i)$ denote the threshold value of γ_i below which θ_i^R is zero, and $\tilde{\gamma}_i(\tau_i)$ the threshold value of γ_i above which θ_i^R is prohibitive, with $\hat{\gamma}_i(\tau_i) \leq \tilde{\gamma}_i(\tau_i)$. To simplify exposition we assume that, if the non-prohibitive interval is non-empty (i.e. $\tilde{\gamma}_i(\tau_i) < \hat{\gamma}_i(\tau_i)$), the function $\theta_i^R(\gamma_i, \tau_i)$ is continuous.³² In the Appendix we prove:

Remark 4. *Given $\tau_i < \tau_i^N$, there exist $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$ (with $\hat{\gamma}_i(\tau_i) \leq \tilde{\gamma}_i(\tau_i)$) such that $\theta_i^R(\gamma_i, \tau_i)$ is zero for $\gamma_i < \hat{\gamma}_i(\tau_i)$, increasing in γ_i for $\gamma_i \in (\hat{\gamma}_i(\tau_i), \tilde{\gamma}_i(\tau_i))$ and prohibitive for $\gamma_i > \tilde{\gamma}_i(\tau_i)$.*

The bang-bang case examined in the previous section corresponds to the case $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$. It is important to keep in mind that we allow for many heterogeneous products, so in general there may be products for which $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$ and products for which $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$. Figure 4 illustrates the RTB response as a function of γ_i , focusing on the former case.

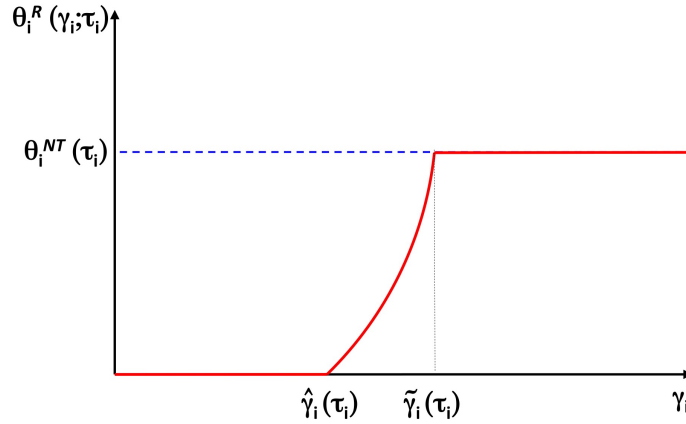


Figure 4: RTB Response as a Function of γ_i : $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$

How do tariff reductions affect RTBs? It is easy to show that reducing τ_i decreases both thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$, and it increases the level of θ_i^R in the non-prohibitive interval if that interval is non-empty. As a consequence, decreasing τ_i increases the probability that product i is affected by RTBs as well as the probability that imports of product i are choked by RTBs.

³²In general $\theta_i^R(\gamma_i, \tau_i)$ may have jumps at $\tilde{\gamma}_i(\tau_i)$ and/or $\hat{\gamma}_i(\tau_i)$. In the case of fixed supply and Pollak demand, for example, it can be shown that $\theta_i^R(\gamma_i, \tau_i)$ may have a jump only at the upper threshold $\tilde{\gamma}_i(\tau_i)$; however, all of our results go through in this case.

At the aggregate level, the above observations imply that tariff liberalization increases the fraction of products choked by RTBs (F^{choke}) as well as the fraction of products “covered” by RTBs (i.e. such that $\theta_i > 0$), which we denote by F^{cov} . With a slight abuse of terminology we will refer to F^{cov} as the “RTB coverage ratio.”³³ Formally, if τ_i decreases for all products, F^{choke} and F^{cov} increase (weakly) in the first-order stochastic sense.

Another important point is the following. If the RTB level is non-prohibitive before the tariff change, it will increase by more than the tariff reduction: $\frac{d\theta_i^R}{d\tau_i} < -1$. To see this, note from (8) that $\frac{d^2V_i}{d\theta_i d\tau_i} = \gamma_i y_i' + \tau_i m_i'' < \frac{d^2V_i}{d\theta_i^2} = \gamma_i y_i' + \tau_i m_i'' - m_i' < 0$. Thus, if RTBs are non-prohibitive, the government *over-compensates* for the tariff reduction with an increase in RTBs, thus *total trade cost increases*. To gain intuition, recall that the FOC for θ_i is $\frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i + \tau_i m_i' = 0$. Start from a point on the RTB response function, where the FOC is satisfied, and decrease τ_i by one unit: to restore the FOC, θ_i must be increased by more than one unit, because θ_i has a smaller impact than τ_i on $\frac{dV_i}{d\theta_i}$, due to the lack of revenue. In the Appendix we show:

Proposition 4. *If τ_i decreases for all products, the fraction of products choked by RTBs (F^{choke}) and the RTB coverage ratio (F^{cov}) increase (weakly) in the first-order stochastic sense. Moreover, for all products such that θ_i is initially non-prohibitive, θ_i increases by more than the tariff reduction ($\frac{d\theta_i^R}{d\tau_i} < -1$), so total trade cost increases.*

The above result has a striking implication for the overall effect of tariff liberalization on the extensive and intensive margins of trade:

Corollary 2. *If τ_i decreases for all products, trade shrinks (weakly) at the extensive margin, and it also shrinks at the intensive margin for all products such that θ_i is non-prohibitive before and after the tariff reduction. Trade can increase at the intensive margin only for products such that $\theta_i = 0$ before the tariff reduction.*

The result that tariff liberalization (combined with the induced RTB response) can lead to a contraction of trade at the extensive margin mirrors the finding in the bang-bang scenario of

³³Note that, while F^{choke} captures the extensive margin of *trade* (since it is the fraction of products that are not traded because of RTBs), F^{cov} captures the extensive margin of RTB use, and the two margins in general are different.

the previous section. But in this richer scenario, tariff reductions can have a perverse negative effect on trade also at the intensive margin: trade volume decreases for products covered by non-prohibitive RTBs, because for these products the government over-compensates for the tariff reduction with an increase in RTBs, so that total trade cost increases.³⁴

Next we focus on the impact of natural trade costs on RTBs. We will show that, for products such that RTBs can be non-prohibitive (i.e. $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$), this impact is dramatically different than for products such that the RTB response is bang-bang (i.e. $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$).

Let us start by considering a decrease in δ_i at the product level. The key observation is that, if $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$, a decrease in δ_i leads to a one-for-one increase in θ_i^R in the non-prohibitive interval $(\hat{\gamma}_i(\tau_i), \tilde{\gamma}_i(\tau_i))$ and a decrease in the lower threshold $\hat{\gamma}_i(\tau_i)$, while the upper threshold $\tilde{\gamma}_i(\tau_i)$ is not affected. That a decrease in δ_i leads to a one-for-one increase in θ_i^R when the latter is non-prohibitive follows from the fact that δ_i and θ_i enter the objective V_i through their sum: here, RTBs are used to neutralize the reduction in natural trade costs. Intuitively, this in turn implies that the lower threshold $\hat{\gamma}_i(\tau_i)$ decreases. And the reason why the upper threshold $\tilde{\gamma}_i(\tau_i)$ is not affected is that, for this level of γ_i , there is an interior maximum for θ_i , and the value of the objective at an interior maximum is not affected by a change in δ_i , since this is fully offset by the change in θ_i .

The above observations have two immediate implications for the impact of natural trade costs at the product level. First, if the non-prohibitive interval of γ_i is non-empty ($\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$), a decrease in δ_i weakly increases θ_i for all γ_i , but the probability of choking is not affected. Second, as δ_i decreases, a range of non-prohibitive θ_i can emerge, but cannot disappear; in other words, the thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$ may separate, but cannot merge. The following proposition (proved in the Appendix) summarizes the impact of natural trade costs at the product level:

Proposition 5. *For a given tariff level τ_i , there exist two intervals of δ_i (each of which may be empty): (i) for high values of δ_i the RTB response is bang-bang, and reducing δ_i decreases the*

³⁴If the tariff reduction triggers RTBs for a product that initially had none (that is, if γ_i is below $\hat{\gamma}_i$ before the change but above $\hat{\gamma}_i$ after the change), the RTB increase may be higher or lower than the tariff decrease.

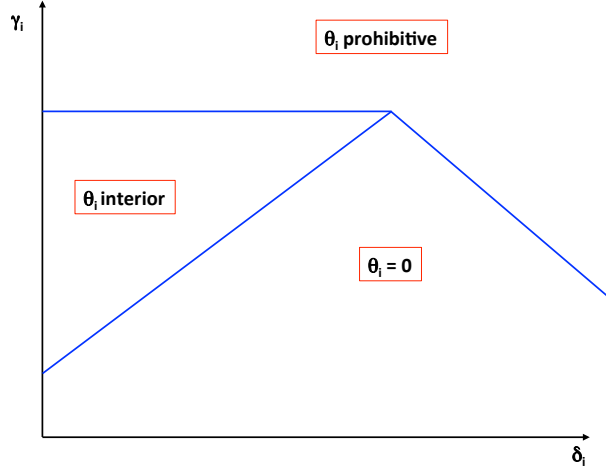


Figure 5: RTBs and Natural Trade Costs in the General Case

probability that imports are choked; (ii) for low values of δ_i the RTB response is non-prohibitive for a range of γ_i , and decreasing δ_i increases this range, while the probability of choking stays unchanged.

Figure 5 illustrates the above result, assuming parameters are such that both intervals of δ_i are non-empty. For a level of δ_i in the higher range, the RTB is either zero or prohibitive depending on γ_i , and the range of γ_i where the RTB is prohibitive shrinks as δ_i goes down. For a level of δ_i in the lower range, an interval of γ_i appears where the RTB is interior, and this interval expands as δ_i falls, while the range of γ_i where the RTB is prohibitive remains unchanged.

Notice the non-monotonic effect of δ_i on the probability that product i is hit by RTBs: as δ_i falls, this probability initially decreases and then it increases.

We are now ready to examine the effects of a general fall in natural trade costs (globalization) at the aggregate level. We let **E** (for “extensive margin”) denote the set of products such that $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$, so that Proposition 5(i) applies, and **I** (for “intensive margin”) the set of products such that $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$, so that Proposition 5(ii) applies. Of course, each of these sets may be empty, depending on parameters. Also, when we talk about a change in the fraction of products choked by RTBs, we mean it in the first-order stochastic sense.

Corollary 3. *Holding tariffs constant, globalization has the following effects: (i) Within product*

set E , the fraction of products choked by RTBs decreases, thus trade expands at the extensive margin. (ii) Within product set I , the extensive margin of trade is not affected, but the RTB coverage ratio increases, and for these products the level of RTBs increases. (iii) Set E shrinks (weakly) in favor of set I .

As Corollary 3 indicates, our model predicts that globalization should reduce RTBs when these operate at the extensive margin of trade, but increase RTBs when these operate at the intensive margin.

The results above also suggest a number of interesting empirical predictions. Conditional on observing non-prohibitive RTBs, these should be *higher* when natural trade costs are lower, both in a cross-sectional sense (RTBs should be higher for products characterized by lower natural trade costs) and in a time-series sense (RTBs should get higher as natural trade costs fall). However, the fraction of products choked by RTBs should *decrease* over time as natural trade costs fall. And by a similar token, products characterized by lower natural trade costs should be less likely to be choked by RTBs.

Before proceeding, we come back to the point made previously that, if RTBs operate at the extensive margin, ignoring the endogenous choice of RTBs will lead to understating the welfare gains from reductions in natural trade costs. In the richer scenario considered here this statement holds, broadly speaking, if product set E is large relative to product set I , so that the extensive-margin effects of RTBs are stronger than their intensive-margin effects.

4.2 Optimal Tariff Commitments

As in section 3, we start by focusing on the benchmark case of no political uncertainty (the “bespoke” tariffs).

Let us first characterize how the RTB response $\theta_i^R(\gamma_i, \tau_i)$ varies with the tariff τ_i for a given γ_i . Recalling Remark 4, it is easy to show that, for a given γ_i , the RTB response θ_i^R is prohibitive for $\tau_i < \tilde{\tau}_i(\gamma_i)$, non-prohibitive and decreasing in τ_i for $\tau_i \in (\tilde{\tau}_i(\gamma_i), \hat{\tau}_i(\gamma_i))$, and zero for $\tau_i > \hat{\tau}_i(\gamma_i)$, where $\tilde{\tau}_i(\gamma_i)$ is the inverse of $\tilde{\gamma}_i(\tau_i)$, and $\hat{\tau}_i(\gamma_i)$ is the inverse of $\hat{\gamma}_i(\tau_i)$.

Now suppose the distribution of γ_i is degenerate at γ_i^0 . We can show that the bespoke tariff is the lowest tariff that does not trigger *any* red tape: $\tau_i^B(\gamma_i^0) = \hat{\tau}_i(\gamma_i^0)$. Intuitively, the reason is that in the non-prohibitive range $(\tilde{\tau}_i(\gamma_i), \hat{\tau}_i(\gamma_i))$ the RTB over-responds to changes in the tariff ($\frac{d\theta_i^R}{d\tau_i} < -1$), as we noted above, so the benefit of lowering the tariff is outweighed by the cost of the induced increase in θ_i^R .

Next consider how the bespoke tariff for product i varies with the natural trade cost δ_i . Recall from Remark 2(ii) that, conditional on the product being in set **E**, the bespoke tariff is increasing in δ_i . Now consider a product in set **I**. We just argued that in this case the bespoke tariff is $\hat{\tau}_i(\gamma_i^0)$. Recall also from the discussion leading to Proposition 5 that $\hat{\gamma}_i(\tau_i)$ increases with δ_i for any given τ_i . This implies that $\hat{\tau}_i(\gamma_i)$ decreases with δ_i for any given γ_i . Thus in this case the bespoke tariff is *decreasing* in δ_i . The intuition is that, when RTBs operate at the intensive margin, reducing δ_i increases the government's incentive to use RTBs, and an increase in the tariff serves to mitigate this incentive. We can thus state:

Remark 5. *If the distribution of γ_i is degenerate at γ_i^0 : (i) The optimal tariff for product i is the lowest τ_i that does not trigger any RTBs. (ii) Conditional on the product being in set **I**, the bespoke tariff is decreasing in δ_i . Conditional on the product being in set **E**, the bespoke tariff is increasing in δ_i .*

As Remark 5 indicates, the result that the bespoke tariff prevents any RTBs from arising applies regardless of whether RTBs operate at the extensive margin or at the intensive margin of trade. On the other hand, natural trade costs have opposite impacts on the bespoke tariff depending on whether RTBs operate at the extensive margin or at the intensive margin.

Recalling from Proposition 5 that a fall in δ_i can induce a switch of product i from set **E** to set **I** (but not vice-versa), Remark 5 also implies an interesting non-monotonicity. In the absence of political uncertainty, as δ_i falls, in general there are two phases (each of which may be empty): in the first phase the optimal tariff decreases, and in the second phase the optimal tariff increases. This in turn suggests that globalization may initially lead to tariff liberalization, but this effect may be reversed at a later stage.

We next consider the impact of natural trade costs on the optimal tariffs in the presence of political uncertainty. Recall from Proposition 3 that, conditional on a product being in set E , the optimal tariff is increasing in δ_i if political uncertainty is sufficiently small, but the effect may get reversed if political uncertainty is large. Next consider a product in set I . Remark 5(ii) suggests that, if political uncertainty is small, the optimal tariff should be decreasing in δ_i . In the Appendix we show that this is true not only with small uncertainty, but for *any* distribution of γ_i . The following proposition summarizes our results about the impact of natural trade costs on the optimal tariffs in this richer scenario:

Proposition 6. *For products in set I , the optimal tariff is decreasing in δ_i , regardless of the degree of political uncertainty. For products in set E , the optimal tariff is increasing in δ_i if political uncertainty is sufficiently small, but this effect may be reversed if political uncertainty is sufficiently large.*

This result confirms that the effects of natural trade costs on the optimal tariffs are qualitatively different depending on whether RTBs operate at the intensive margin or at the extensive margin of trade.

5 Partially Wasteful Trade Barriers

Thus far we have focused on import barriers that do not generate rents. How do our results extend to the case of import barriers that generate some rents? To address this question, we revisit the previous analysis by assuming that a fraction $\phi_i > 0$ of the rents associated with the trade barrier θ_i is wasted, as in Anderson and Neary (1992) and Limão and Tovar (2011). The model analyzed in the previous sections corresponds to the special case where ϕ_i equals one. We refer to this more general import barrier as a “Non Tariff Barrier” (NTB).³⁵

The government’s objective function for good i now becomes $V_i = s_i(p_i) + (1 + \gamma_i)\pi_i(p_i) +$

³⁵One of the possible interpretations for the waste of rents is that some rents are dissipated through rent-seeking activities, or in Jagdish Bhagwati’s terminology, “directly unproductive profit-seeking” activities (see Bhagwati (1982)). Note that under this interpretation ϕ_i could in principle be higher than one (implying that rents are negative); our results can be easily extended to consider this case.

$(\tau_i + (1 - \phi_i)\theta_i) m_i$, where $(1 - \phi_i)\theta_i m_i$ is the revenue generated by the NTB. For any $\phi_i > 0$, the NTB is a less efficient instrument than a tariff, therefore in the absence of restrictions on tariffs the government will not use NTBs. But if tariffs are constrained by a trade agreement, then the government may have an incentive to use NTBs.

For simplicity, in this section we focus on the case of linear demand and fixed supply. The first step is to consider whether the government objective is convex or concave. It is immediate to derive: $\frac{d^2 V_i}{d\theta_i^2} = (1 - 2\phi_i)m'_i$. Clearly, V_i is concave in θ_i if and only if $\phi_i < 1/2$, that is, if NTBs are sufficiently wasteful. If $\phi_i > 1/2$, all our results from Section 3 continue to hold. We next examine the case $\phi_i < 1/2$.

If $\phi_i < 1/2$, so that V_i is concave in θ_i , the characterization of the NTB response function is the same as in Section 4. In particular, θ_i^R is zero for low values of γ_i , prohibitive for high values of γ_i , and non-prohibitive for an intermediate interval of γ_i , as in Remark 4. Moreover, the impact of tariff reductions is the same as described in Proposition 4.

Interestingly, however, the impact of natural trade costs on the optimal NTBs is very different from Section 4. If δ_i decreases then θ_i^R goes down weakly for all γ_i and τ_i , and both thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$ increase. As a consequence, globalization leads to an increase in trade both at the extensive margin (the fraction of products whose imports are choked by NTBs goes down) and at the intensive margin, and the fraction of products covered by NTBs decreases. What underlies these results is the fact that, if $\phi_i < 1/2$, NTBs and natural trade costs are complementary. To see this, notice that with linear demand and fixed supply we have $\frac{d^2 V_i}{d\delta_i d\theta_i} = -\phi_i m'_i > 0$, and given that $\frac{d^2 V_i}{d^2 \theta_i} < 0$ it follows that $\frac{d\theta_i^R}{d\delta_i} > 0$. Notice the contrast between this case and the case of non-prohibitive RTBs for $\phi_i = 1$ (examined in Section 4), where RTBs and natural trade costs are substitutes.

A further prediction of this extension of our model is that, as NTBs become more wasteful, they can switch from an interior solution to a corner solution, but not vice-versa. This suggests that we should tend to observe fewer non-prohibitive NTBs when these are more wasteful, and by a similar token, more wasteful NTBs should have a relatively bigger impact on the extensive margin than on the intensive margin of trade.

Finally, this extension of our model suggests another reason (in addition to the one mentioned in footnote 27) why RTBs are more common in developing countries. Given that developing countries have weaker institutions, in these countries RTBs can be more easily used to elicit bribes from exporters, and since bribes are a form of rents associated with RTBs, this implies that RTBs can generate more rents – and thus should be more common – in developing countries.

6 Terms-of-Trade Motivated Trade Agreements

So far we have focused on domestic commitment as the motivation for a trade agreement. As we show in this section, the main qualitative insights hold when trade agreements are motivated by the presence of terms-of-trade (TOT) externalities. The economic structure is analogous to that of our basic model, except that now there are two large countries, Home and Foreign. We continue to assume that markets are perfectly competitive and that the economy produces a continuum of products plus an outside good (which again we take to be the numéraire). Home is the natural importer of all non-numéraire goods.

The Home government can use both tariffs and RTBs to maximise its politically-adjusted welfare function \bar{V} . For simplicity we return to the case of totally wasteful RTBs. Focusing on a single product, the Home government's payoff is as before $V_i = s_i + (1 + \gamma_i)\pi_i + \tau_i m_i$. To keep the exposition as simple as possible, we assume that the Foreign government is passive and its payoff is $V_i^* = s_i^* + (1 + \gamma_i^*)\pi_i^*$.³⁶

As in the small-country setting, in the absence of trade agreements the Home government would never use RTBs, because RTBs are dominated by tariffs.³⁷ Assuming that V_i is concave

³⁶For a similar partial-equilibrium setting where trade agreements are motivated by terms-of-trade externalities, see for example Bagwell and Staiger (2001b) and Horn et al. (2010).

³⁷Also notice that, even if the Home country has the power to manipulate terms of trade, it has no incentive to use RTBs for this purpose, given that they do not generate revenue. Indeed, absent political pressures there would be no RTBs even in this large-country setting. This is another important difference between tariffs and RTBs.

in τ_i , the optimal noncooperative tariff is defined by the following first-order condition:

$$\frac{dV_i}{d\tau_i} = (\gamma_i y_i + \tau_i m'_i - m_i) \frac{dp_i}{d\tau_i} + m_i = 0 \quad (13)$$

This yields the optimal noncooperative tariff: $\tau_i^N = \frac{\gamma_i y_i}{-m'_i} + \frac{1-p_i \tau_i}{p_i \tau_i} \frac{m_i}{-m'_i}$. In this large country case, tariffs are used not only to protect domestic producers, but also to improve Home's terms of trade at the expense of Foreign. This terms-of-trade externality leads to trade policy choices which are inefficient from the perspective of the governments' joint payoff. The objective of a trade agreement in this setting is to correct this inefficiency. Thus here we abstract from domestic commitment motives. At the ex-ante stage, the governments sign a trade agreement on tariffs that maximizes the governments' joint payoff $\bar{V} + \bar{V}^*$.³⁸ At the ex-post stage, Home chooses its RTBs to maximize its payoff \bar{V} subject to the constraints on tariffs imposed by the trade agreement.

As in the small country case, we assume that the political weights for each product, γ_i and γ_i^* , are observed ex post but uncertain ex ante, and that the tariffs specified in the agreement cannot be contingent on these political shocks.

We will revisit the results of Section 4, which focuses on the richer scenario where RTBs can operate at both the extensive and intensive margins of trade. In the interest of space, we focus on the optimal choice of RTBs when tariff commitments are exogenously given. As before, we can focus on a single product i . Similarly to the case of a small country with commitment motives, given the tariff τ_i , there will be two thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$, with $\hat{\gamma}_i(\tau_i) \leq \tilde{\gamma}_i(\tau_i)$, such that for $\gamma_i \leq \hat{\gamma}_i(\tau_i)$ the optimal RTB is zero, for $\gamma_i \geq \tilde{\gamma}_i(\tau_i)$ the optimal RTB is prohibitive, and for $\gamma_i \in (\hat{\gamma}_i(\tau_i), \tilde{\gamma}_i(\tau_i))$ the optimal RTB is positive but non-prohibitive. If V_i is convex in θ_i then $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i) = \gamma_i^J(\tau_i)$, and the optimal RTB response function is bang-bang, as in Section 3.

It can easily be shown that the thresholds $\hat{\gamma}_i$ and $\tilde{\gamma}_i$ vary with the tariff τ_i and the natural

³⁸The interpretation of this assumption is that governments bargain efficiently over the Home tariffs and a transfer (from Foreign to Home), with the transfer entering payoffs linearly. So, if T is the transfer made by Foreign, Home's (resp. Foreign's) payoff inclusive of the transfer is $\bar{V} + T$ (resp. $\bar{V}^* - T$). This payoff structure, together with efficient bargaining, implies that tariffs will maximize $\bar{V} + \bar{V}^*$.

trade cost δ_i in the same qualitative way as in Section 4. As a consequence, the results of Propositions 6 and 7 regarding the effects of tariff reductions and globalization on RTBs, as well as the results of Corollaries 2 and 3 on the overall impacts that these changes have on the extensive and intensive margins of trade, are qualitatively analogous to those in the case of a small country with commitment motives.

7 Conclusion

Red-tape barriers to trade are pervasive but have received little attention from scholars to date. In this paper we have taken a first step in exploring the implications of RTBs, and have shown that they are very different from those of more traditional trade barriers.

In our model, politically-motivated governments may have incentives to impose RTBs even though they yield no revenue, if a trade agreement can constrain tariffs but not RTBs. At the agreement stage, the extent of tariff liberalization is limited by the need to prevent such wasteful behavior: tariffs need to be set above the level that would be optimal with a complete agreement to avoid a “protectionist backlash” in the form of RTBs. However, RTBs may nonetheless emerge in equilibrium, if the tariff commitments are not fully contingent. The model further suggests that RTBs tend to be more frequent in equilibrium when the degree of political uncertainty is higher.

When RTBs are used, they are likely to “choke” trade for a range of products, implying that the extensive margin is key for understanding the impact of RTBs. At the same time, non-prohibitive RTBs can arise for products characterized by a sufficiently concave import demand. Whether RTBs operate at the extensive margin or at the intensive margin also matters for the effects of globalization: reductions in natural trade costs reduce a government’s incentive to resort to RTBs when these operate at the extensive margin of trade, but increases the level of RTBs when these operate at the intensive margin.

In the presence of RTBs, tariff liberalization can have perverse effects on trade, to the extent that it induces an increase in RTBs. At the extensive margin, tariff reductions lead to a weak

contraction of trade, and at the intensive margin, trade volume decreases for products covered by non-prohibitive RTBs, because the government over-compensates for the tariff reduction with an increase in RTBs. Tariff reductions increase trade only for products that are unencumbered by RTBs, which is the case if political pressures are sufficiently low.

Finally our model suggests an important lesson for studies that seek to evaluate the welfare gains from reducing tariffs or natural trade costs. Ignoring RTBs will lead to *overstating* the welfare gains from tariff liberalization, but may well lead to *understating* the welfare gains from globalization. This is because tariff reductions trigger policy substitution toward RTBs, while reductions in natural trade costs mitigate a government's incentive to use RTBs, to the extent that RTBs operate at the extensive margin of trade.

In this paper we have focused on purely wasteful red tape barriers to trade. In reality, wasteful red tape sometimes takes the form of product regulations, when these are imposed for protectionist reasons. An interesting direction for future research would be to consider product standards that may have legitimate welfare justifications but may also be used for protectionist reasons. Also, our model abstracts from considerations of product substitutability and factor-price effects of RTBs; it would be valuable to introduce such general-equilibrium effects in future extensions of the model.

Appendix

Throughout the Appendix we omit the product index i , as this should not create confusion.

Proof of Proposition 3

We start by giving a heuristic proof for the first part of Proposition 3, that the optimal tariff is increasing in δ if the distribution of γ is sufficiently concentrated. Fix two levels of δ , say $\delta' < \delta''$, and consider a distribution G that is close (for example in the weak-convergence sense) to the degenerate distribution at γ^0 , which we denote G^0 . We now argue that if G is sufficiently close to G^0 then the optimal tariff for $\delta = \delta'$ must be lower than the optimal tariff for $\delta = \delta''$. To see this, recall from Figure 3 how expected welfare depends on the tariff for a degenerate distribution such as G^0 : it is constant up to the bespoke tariff, where it jumps up, and then decreases monotonically as the tariff rises above the bespoke tariff. We denote $\tau^B(\gamma^0, \delta)$ the bespoke tariff as a function of γ^0 and δ . Clearly, for a given level of δ , if G is close to G^0 then the shape of the expected-welfare function is close to that of the welfare function drawn in Figure 3, so the optimal tariff is close to the bespoke tariff $\tau^B(\gamma^0, \delta)$. Now recall that the bespoke tariff is increasing in δ , so $\tau^B(\gamma^0, \delta') < \tau^B(\gamma^0, \delta'')$. It follows immediately that, if G is sufficiently close to G^0 , the optimal tariff for $\delta = \delta'$ must be lower than the optimal tariff for $\delta = \delta''$.

To prove the second part of the proposition, that globalization can raise the optimal commitment tariff if political uncertainty is large enough, it is sufficient to consider the special case of linear demand, fixed supply and Pareto distribution. Recall the first-order condition given by equation (12):

$$\bar{W}_\tau = G' \gamma_\tau^J \Delta W + G W_\tau = 0 \quad (14)$$

Relative to the text, this is written more compactly by omitting the arguments of all functions.

Now, differentiate this with respect to δ :

$$\bar{W}_{\tau\delta} = G'' \gamma_\delta^J \gamma_\tau^J \Delta W + G' \gamma_{\tau\delta}^J \Delta W + G' \gamma_\tau^J W_\delta + G' \gamma_\delta^J W_\tau + G W_{\tau\delta} \quad (15)$$

With linear demand and fixed supply, we have $\gamma_{\tau\delta}^J = W_{\tau\delta} = 0$ and $\gamma_\delta^J + \gamma_\tau^J = 0$, thus:

$$\bar{W}_{\tau\delta} = G'' \gamma_\delta^J \gamma_\tau^J \Delta W + G' \gamma_\tau^J (W_\delta - W_\tau) = (G'' \gamma_\delta^J \Delta W - G' m) \gamma_\tau^J \quad (16)$$

where we used the fact that $W_\delta - W_\tau = -m$. Next we substitute from the first-order condition (14), which implies that $\gamma_\delta^J \Delta W = -\gamma_\tau^J \Delta W = \frac{G}{G'} W_\tau$, and use $W_\tau = \tau m'$, to obtain:

$$\bar{W}_{\tau\delta} = \left(\frac{GG''}{(G')^2} \frac{\tau}{p} \frac{pm'}{m} - 1 \right) m G' \gamma_\tau^J \quad (17)$$

Using the Pareto distribution, $G = 1 - (\gamma^0)^k \gamma^{-k}$, where the shape parameter k is an inverse measure of dispersion: $G_k = - (1 - G) \log \left(\frac{\gamma^0}{\gamma} \right) > 0$. Note that $G' = k (\gamma^0)^k \gamma^{-k-1} = \frac{k}{\gamma} (1 - G)$ and $G'' = -k(k+1) (\gamma^0)^k \gamma^{-k-2} = -\frac{k(k+1)}{\gamma^2} (1 - G)$. Substituting into (17) gives:

$$\bar{W}_{\tau\delta} = - \left(\frac{k+1}{k} \frac{G}{1-G} \frac{\tau}{p} \frac{pm'}{m} + 1 \right) m G' \gamma_\tau^J \quad (18)$$

Clearly this is negative for k sufficiently low, in line with the second part of the proposition.

Proof of Remark 4

The key step is to note that $V_{\theta\gamma} = y > 0$. This immediately implies that $\theta^R(\tau, \gamma)$ is weakly increasing in γ . Thus, for any given $\tau < \tau^N$, in general there are three intervals of γ , each of which may be empty: a low interval $(\gamma_{min}, \hat{\gamma}(\tau))$ where $\theta^R = 0$, an intermediate interval $(\hat{\gamma}(\tau), \tilde{\gamma}(\tau))$ where θ^R is positive but non-prohibitive, and a high interval $(\tilde{\gamma}(\tau), \gamma_{max})$ where θ^R is prohibitive. And since $V_{\theta\gamma}$ is strictly positive, θ^R is strictly increasing in the intermediate range $(\hat{\gamma}(\tau), \tilde{\gamma}(\tau))$.

Proof of Proposition 4

In order to prove the aggregate results of Proposition 4, we start by showing how a tariff change affects the RTB response function at the product level. In this proof we focus on the case $\hat{\gamma}(\tau) < \tilde{\gamma}(\tau)$, since we already dealt with the bang-bang case $(\hat{\gamma}(\tau) = \tilde{\gamma}(\tau))$.

We already established in the text that $\frac{d\theta^R}{d\tau} < -1$ in the non-prohibitive range, so we can focus on how the tariff affects the two thresholds $\hat{\gamma}(\tau)$ and $\tilde{\gamma}(\tau)$. Let us start with $\hat{\gamma}(\tau)$. Recalling Remark 4 and the assumption that θ^R is continuous, the first-order condition for optimality of θ must be satisfied at this threshold, so $\hat{\gamma}(\tau)$ is implicitly defined by $V_\theta(\tau, 0, \hat{\gamma}) = 0$. Differentiating this equation in $\hat{\gamma}$ and τ , we obtain $\frac{d\hat{\gamma}}{d\tau} = -\frac{V_{\theta\tau}}{V_{\theta\gamma}}$. Note that the second-order condition $V_{\theta\theta} < 0$ must hold, so $V_{\theta\tau} < V_{\theta\theta} < 0$, and furthermore $V_{\theta\gamma} = y > 0$, thus we can conclude that $\frac{d\hat{\gamma}}{d\tau} > 0$.

Next focus on the threshold $\tilde{\gamma}(\tau)$. This is implicitly defined by $V_\theta(\tau, \theta^{NT}(\tau), \tilde{\gamma}) = 0$. Differentiating this equation in $\tilde{\gamma}$ and τ , we obtain $\frac{d\tilde{\gamma}}{d\tau} = \frac{V_{\theta\theta} - V_{\theta\tau}}{V_{\theta\gamma}}$, where we used the fact that $\frac{d\theta^{NT}}{d\tau} = -1$ (which in turn follows from the fact that $\theta^{NT}(\tau)$ is defined by the condition that $\theta + \tau$ equals the minimum prohibitive trade cost level). Again noting that $V_{\theta\tau} < V_{\theta\theta} < 0$ and $V_{\theta\gamma} > 0$, it follows that $\frac{d\tilde{\gamma}}{d\tau} > 0$.

Consider next the probability that $\theta > 0$. Recalling that RTBs are imposed if $\gamma > \hat{\gamma}(\tau)$, we obtain:

$$\Pr[\theta > 0] = \int_{\hat{\gamma}(\tau)}^{\gamma^{\max}} g(\gamma) d\gamma = 1 - G(\hat{\gamma}(\tau)) \quad (19)$$

Differentiating shows that this is decreasing in τ :

$$\frac{d\Pr[\theta > 0]}{d\tau} = -g(\hat{\gamma}(\tau)) \frac{d\hat{\gamma}}{d\tau} < 0 \quad (20)$$

where we used the fact that $\frac{d\hat{\gamma}}{d\tau} > 0$. A similar argument allows us to sign the effect of τ on the probability that θ chokes imports:

$$\Pr[\theta \geq \theta^{NT}] = \int_{\tilde{\gamma}(\tau)}^{\gamma^{\max}} g(\gamma) d\gamma = 1 - G(\tilde{\gamma}(\tau)) \quad (21)$$

Differentiating and using $\frac{d\tilde{\gamma}}{d\tau} > 0$ we conclude that this too is decreasing in τ .

Having established that a tariff reduction decreases the probability that a product is covered by an RTB and the probability that it is choked by an RTB, it follows immediately that both F^{choke} and F^{cov} increase in the first-order stochastic sense.

Proof of Proposition 5

Part (i) has been proved already, so we can focus on Part (ii). In this proof we suppress the argument τ and highlight instead the argument δ , so we write the government objective as $V(\delta, \theta, \gamma)$ and the prohibitive level of θ as $\theta^{NT}(\delta)$. All we need to prove is that a decrease in δ leads to a reduction of the threshold $\hat{\gamma}$ and does not affect the threshold $\tilde{\gamma}$.

Consider first the effect of a change in δ on the threshold $\hat{\gamma}$. Recalling Remark 4 and the assumption that θ^R is continuous, $\theta = 0$ satisfies the first-order condition at this threshold, hence $V_\theta(\delta, 0, \hat{\gamma}) = 0$. Differentiating this equation with respect to δ and $\hat{\gamma}$, we obtain $\frac{d\hat{\gamma}}{d\delta} = -\frac{V_{\theta\delta}}{V_{\theta\gamma}} = -\frac{V_{\theta\theta}}{V_{\theta\gamma}}$. Since the second-order condition $V_{\theta\theta} < 0$ must hold and $V_{\theta\gamma} > 0$, it follows that $\frac{d\hat{\gamma}}{d\delta} > 0$.

Consider next how δ affects the threshold $\tilde{\gamma}$. Again recalling Remark 4 and the assumption that θ^R is continuous, $\theta = \theta^{NT}(\delta)$ satisfies the first-order condition at this threshold, hence $V_\theta(\delta, \theta^{NT}(\delta), \tilde{\gamma}) = 0$. Differentiating this equation with respect to $\tilde{\gamma}$ and δ , we obtain $\frac{d\tilde{\gamma}}{d\delta} = -\frac{V_{\theta\theta} - V_{\theta\delta}}{V_{\theta\gamma}}$, where we used the fact that $\frac{d\theta^{NT}}{d\delta} = -1$ (which in turn follows from the fact that $\theta^{NT}(\delta)$ is defined by the condition that the total trade cost equals the minimum prohibitive trade cost level). But $V_{\theta\theta} = V_{\theta\delta}$, thus it follows that $\frac{d\tilde{\gamma}}{d\delta} = 0$.

Proof of Proposition 6

We wish to show that, conditional on product i being in set I, the optimal commitment tariff is decreasing in δ , regardless of the distribution of γ .

We can write expected welfare as:

$$EW = \int_{\gamma^{min}}^{\hat{\gamma}(\tau)} W(\tau, 0)g(\gamma)d\gamma + \int_{\hat{\gamma}}^{\tilde{\gamma}(\tau)} W(\tau, \theta^R(\gamma, \tau))g(\gamma)d\gamma + \int_{\tilde{\gamma}(\tau)}^{\gamma^{max}} W^{NT}g(\gamma)d\gamma \quad (22)$$

We want to evaluate the cross derivative of (22) with respect to δ and τ . Consider first the first derivative with respect to δ . Recall that, when θ^R is non-prohibitive, a change in δ is exactly offset by a change in θ^R , thus leaving welfare unchanged. Hence δ does not affect the second integrand. Also the no-trade level of welfare is unaffected by δ , so the third integrand is

unaffected by δ . Next, note that we can ignore the effect of δ on the boundaries $\hat{\gamma}(\tau)$ and $\tilde{\gamma}(\tau)$, because welfare is continuous at the lower boundary, and the upper boundary is unaffected by δ . Thus the derivative of (22) with respect to δ is simply: $G(\hat{\gamma}(\tau))\frac{\partial}{\partial\delta}W(\tau, 0)$. The cross-derivative of expected welfare with respect to δ and τ is therefore:

$$\frac{\partial^2 EW}{\partial\delta\partial\tau} = G(\hat{\gamma}(\tau))\frac{\partial^2 W(\tau, 0)}{\partial\delta\partial\tau} + g(\hat{\gamma}(\tau))\hat{\gamma}'(\tau)\frac{\partial W(\tau, 0)}{\partial\delta} < 0 \quad (23)$$

where we have used the fact that $\frac{\partial^2 W(\tau, 0)}{\partial\delta\partial\tau}$ has the same sign as m'' , which recall is negative for products in set I, and that $\hat{\gamma}'(\tau) > 0$ (from Proposition 4). It follows that, conditional on the product being in set I, a small decrease in δ leads to an increase in the optimal tariff.

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