Choked by Red Tape?
The Political Economy of Wasteful Trade Barriers*

[Preliminary and Incomplete]

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Abstract

Red-tape barriers (RTBs) are an important source of trade costs, but have received little attention in the trade literature. In this paper we take a first step toward a theory of RTBs, and show that their implications can be very different from those of more traditional trade barriers. The model highlights that RTBs have important impacts on the extensive margin of trade, and yields rich comparative-statics predictions on how RTBs are affected by product characteristics and by changes in the economic-political environment, including changes in natural trade costs ("globalization"). Moreover, the availability of RTBs affects in interesting ways the tariff commitments specified in a trade agreement.

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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 obstacle is represented by "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 different documents, or difficulties with translating or filling out forms); information/transparency issues (e.g., information concerning the licensing/certification process is not adequately published and disseminated, or is inaccurate, or changes frequently); 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: an interesting recent example is given by India's decision in 2015 to allow apple imports only via the port of Mumbai, while other ports such as Chennai were more efficient options for serving large parts of the country.[2]

Next we briefly discuss the available empirical evidence on the impact of RTBs.

There is an abundance of studies showing that RTBs are quantitatively important barriers

[1]It is interesting to note that, when EU exporters are asked about the regulations they face in the importing country, they complain more about the procedural obstacles associated 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. It is a hit or miss situation, and it can be arbitrary." (ITC (2016), page 9)

[2]There are strong indications that this was a deliberate protectionistic measure. 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" (thedollarbusiness.com/magazine/applelooks-attractive-sells-well-too/45886).

to trade. 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 is due to administrative hurdles, such as customs procedures, tax procedures, clearance and inspections.

Perhaps surprisingly, RTBs are very common in developed countries, although they are even more common in developing countries. This point is clearly illustrated by the ITC survey (see Figure 4 and Figure B2 in ITC (2016)).[3] Another interesting fact is that there seems to be little difference in the impact of RTBs on small versus large firms (see Figure 3 and Table 7 in ITC (2016)). Furthermore, depending on the exact type of procedural obstacles, RTBs may affect the variable costs and/or the fixed costs of trade.[4]

Finally, and importantly, RTBs are often prohibitive, and have important impacts on the extensive margin of trade. A number of recent papers, including Dennis and Shepherd (2011), Nordas et al. (2006), Persson (2013), Hendy and Zaki (2013), Feenstra and Ma (2014) and Fontagné et al. (2016) examine the trade impact of various indexes of RTBs or (inversely) of trade facilitation, finding that they have a significant impact on the number of imported varieties.[5] In particular, Fontagné et al. (2016) find that reducing by 10% the

[3] As an interesting example of RTB imposed by a developed country, a Germany-based wood products exporter 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" (ITC (2016)).

[4] As an example of RTBs that affect variable costs, "a small German company exporting musical instruments to India was not aware that a compulsory inspection takes place at the Indian Customs 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)). As an example of RTBs affecting fixed costs, a Bulgarian exporter of wooden windows to China reports: "We have to certify our products with the China Compulsory Certificate, which can only be obtained after the products have been tested in China. This is burdensome because there is an unusually high fee of about 2,000 euros per product variety, but also because the testing requirements are not revealed by the Certification and Accreditation Administration of China" (ITC (2016)).

[5] While some of these authors suggest that these findings reflect firm-selection effects due to fixed trade

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; this confirms that large firms are no less affected by RTBs than small firms.

In spite of their empirical importance, RTBs have largely been ignored by the trade literature. In this paper we take a first step toward a theory of RTBs, with the objective of improving our understanding of the economic and political determinants of RTBs and their effects on trade. We will show that the implications of RTBs can be quite subtle and substantially different from those of more traditional trade barriers. Furthermore, the model offers an interesting lens to interpret some of the empirical facts mentioned above, and in particular the impact of RTBs on the extensive margin of trade.

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. On the other hand, more traditional trade barriers such as tariffs can be effectively constrained by a trade agreement. This leads to a number of interesting questions. A first set of questions concerns the determinants of RTBs and their effects on trade given the tariffs specified in the agreement: How do equilibrium RTBs depend on the tariff levels? How do they respond to changes in "natural" trade costs? How do they affect the intensive and extensive margins of trade? A second set of questions concerns the optimal cooperative tariffs: How are they affected by the anticipation that governments may resort to RTBs ex post? How do they depend on the "fundamentals" of the economic-political environment, such as natural trade costs and the degree of political uncertainty?

To make the main points more transparently, we focus on a standard economic structure in the same spirit as Grossman and Helpman (1994), capturing domestic political-economy pressures in reduced form by assuming that governments attach extra weight to domestic

costs, we note that these studies use product-level data, so the mechanism explaining these findings is not obvious to us. In this paper we will suggest a different possible mechanism that might explain the extensive-margin impact of RTBs.

producers in import-competing industries.

Governments have two types of trade policy at their disposal: standard 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 pressure parameters are uncertain. Importantly, the trade agreement is incomplete in two dimensions. First, the agreement can only cover tariffs, so it leaves RTBs to the governments' discretion. Second, the tariffs specified in the agreement cannot be fully contingent on the level of political pressures in the various industries.

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 qualitative insights extend to this setting.

We next briefly preview our main results.

We start by examining a government's choice of RTBs given the tariffs specified in the agreement.[6] We find that, for a given product, if import demand is not too concave, the optimal RTB is either zero or it chokes off imports, depending on the realized level of political pressure. The reason for this "bang-bang" outcome is that, unless import demand is very concave, the politically-adjusted welfare function maximized by the government is convex in the RTB. Moreover, the probability that a given product is imported decreases, other things equal, if the tariff on that product exogenously falls. And at the aggregate level, a general (exogenous) decrease in tariffs leads to a reduction in the number of imported products, that

[6]The case of exogenous tariff commitments is interesting for three reasons. First, when we examine the comparative-statics effects of parameter changes, this can be interpreted as a short-run analysis, to the extent that tariffs cannot be renegotiated frequently. Second, this can capture cases in which a country has little choice on the tariff commitments, for example because it must decide whether or not to join a pre-existing trade agreement. And third, when we examine the effect of exogenous changes in the tariffs on RTBs, this can be interpreted as the effect of changes in tariffs caused by shocks that are outside our model.

is, a contraction of trade at the extensive margin.

We then examine the impact of "natural" trade costs on RTBs, holding tariffs fixed. Still focusing on the "bang-bang" case, we find that lower natural trade costs *reduce* the government's incentive to use RTBs. At the product level, the probability that the product is imported in equilibrium is higher, other things equal, for products with lower natural trade costs; at the aggregate level, a general decrease in natural trade costs ("globalization") increases the number of imported products, thus trade expands at the extensive margin. This seems surprising, given that natural trade costs and RTBs in our model have identical economic effects. We will argue that this result is fundamentally tied to the feature that RTBs affect trade through the extensive margin.

As this first set of results highlights, in our model RTBs affect trade through the extensive margin, at least for products whose import demand is not too concave. Thus the model offers an interesting perspective on the empirical evidence discussed above that RTBs have important impacts on the extensive margin of trade. In the existing literature, the most popular explanation for the extensive-margin impact of trade barriers is that there is an important fixed-cost component to such barriers, so they generate selection effects across firms and products. Our model, on the other hand, can explain extensive-margin effects of RTBs – and more generally of wasteful policy-induced trade barriers – without invoking any fixed costs (and without appealing to imperfect competition). Rather, the extensive-margin effects of RTBs in our model arise from a fundamental non-convexity in the government optimization problem.[7]

We then consider a more general scenario where there may be products of two types: those characterized by a bang-bang RTB response, so that RTBs operate only at the extensive margin (as explained above), and those for which RTBs may be non-prohibitive, so that they can operate also through the intensive margin. We refer to the former set of products as set

[7]A natural question that arises is whether the available empirical evidence is consistent with our story, the fixed-cost story, neither, or both. This question is beyond the scope of this paper, but we note that some of the recent empirical literature casts some doubt on the quantitative importance of fixed trade costs at the product-destination level. See, for example, Besedes and Prusa (2006).

E, and to the latter as set I. For products in set I, RTBs are non-prohibitive for a certain range of tariffs and political weights. In this richer world, RTBs affect trade both at the intensive and at the extensive margin. We find that an exogenous fall in tariffs increases the level of non-prohibitive RTBs for products that are imported in equilibrium, and decreases the number of imported products.

In this richer scenario, the impact of globalization on RTBs (holding tariffs fixed) is particularly subtle. At the product level, as the natural trade cost falls there are two phases (each of which may be empty): in the first phase the product is in set E, and reductions in the natural trade cost reduce the probability that imports are choked by RTBs; in the second phase the product switches to set I, and as the natural trade cost keeps falling, the probability of choking stays unchanged but the average level of RTBs goes up, thus affecting trade only at the intensive margin. This point is worth emphasizing: globalization reduces 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.

As a consequence of the results just mentioned, the model yields a couple of interesting predictions. First, conditional on observing non-prohibitive RTBs, these should be higher when natural trade costs are lower, both in a cross-product sense and in a time-series sense. Second, the fraction of products whose imports are 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.

The next step of our analysis is to examine the optimal choice of tariff commitments.

We start by considering the benchmark case of no political uncertainty (i.e., the level of political pressure in each industry is known ex ante). In this case, we find that the optimal tariff cuts *just* prevent RTBs from arising in equilibrium (regardless of whether the product is in set E or in set I). But even if RTBs remain off-equilibrium, the possibility of their use affects the extent of tariff liberalization: tariffs are set above the level that would be optimal with a complete agreement in order to avoid a "protectionist backlash" in the form of RTBs.

In the presence of political uncertainty, the optimal tariff commitments induce RTBs in equilibrium for a given product when political pressures are high. Indeed, the model suggests that more political uncertainty tends to induce more RTBs. When we examine how the degree of political uncertainty affects the optimal tariff level, for products in set `E` we find an interesting non-monotonicity: as we increase uncertainty (in a median-preserving way) starting from zero, the optimal tariff must first increase and then decrease.[8]

We then focus on the effect of globalization on the optimal tariffs. Recall that for products in set `E`, holding tariffs fixed, globalization reduces a government's incentive to use RTBs. Thus, intuitively, globalization should reduce the need to keep tariffs high in order to mitigate such incentive. We find that this intuition is indeed correct if political uncertainty is relatively small. Thus the model suggests an interesting possible explanation for the fact that tariffs have come down gradually over time. At the same time, we find that for products in set `I` globalization leads to an increase in the optimal tariffs (an intuitive consequence of the fact that, for these products, globalization increases RTBs for given tariffs); and this may be true even for products in set `E` if political uncertainty is large enough.

In the final part of the paper, we extend the model in two directions: we consider the case of partially wasteful trade barriers (meaning that only part of the revenue/rents associated with the policy is wasted), and the case of two large countries that sign a trade agreement to address terms-of-trade externalities. In both cases, we show that our main results continue to hold, though with some interesting qualifications in each case.

There is a large theoretical literature on non-tariff barriers to trade, and in particular on quantitative restrictions, such as import quotas and VERs. But these trade barriers are different in nature than RTBs, because they generate revenue or rents, and for this reason their implications are very different from those of RTBs. There are also many papers on production subsidies and behind-the-border measures that can be used as indirect protectionist tools (for example Copeland (1990), Bagwell and Staiger (2001), and Horn et al. (2010). But

[8] This result does not hold for products in set `I`: for these products, the impact of political uncertainty is ambiguous.

again, the implications of these policies are quite different from those of RTBs.

Limão and Tovar (2011) consider non-tariff barriers with partial waste of revenue, but the focus of their paper is 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 focus on cases where the government's objective is concave in the non-tariff barrier (for any tariff level), and hence the optimum is interior. As we argue in section 5, this is the case only if the waste of revenue is relatively small, which is not the case for RTBs. Another related paper is Staiger (2012), who focuses on trade facilitation agreements that encourage trade-cost-reducing investments. This setting is in some ways complementary to ours, in that we allow a government to freely increase trade costs above their "natural" levels, while Staiger allows a government to decrease trade costs below their "natural" levels by making costly investments. A desirable direction for future research would be to consider a unified setting which allows for both possibilities.

The paper is structured as follows. In Section 2 we lay out the basic model. Section 3 focuses on the scenario in which RTBs affect only the extensive margin of trade. Section 4 considers the scenario where RTBs can affect also the intensive margin. Section 5 considers the case of partially wasteful trade barriers. Section 6 considers two large countries that sign a trade agreement to address terms-of-trade externalities. Section 7 concludes.

2 The Basic Model

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 this basic model we assume quasi-linear and separable preferences, in order to make our key points in the most transparent way, but later in the paper we will extend the analysis to allow for substitution effects. For now, the preferences of each individual at Home are assumed to be the following:

$$U = x_0 + \int_i u_i(x_i)\mathrm{d}i \tag{1}$$

The first-order conditions from maximizing this utility function subject to the consumer's budget constraint lead to demand functions for each of the imported goods that depend only on the good's own price:

$$x_i(p_i) = -s_i'(p_i), \quad \text{where:} \quad s_i(p_i) \equiv u_i(x_i(p_i)) - p_i x_i(p_i) \tag{2}$$

Here $s_i(p_i)$ 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, we assume that 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 for each specific factor 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 $\pi_i = r_i K$. Given the technology structure 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 good is exported. We will focus on specific tariffs τ_i. The revenue from a tariff is $\tau_i m_i(p_i)$, where $m_i(p_i) = x_i(p_i) - y_i(p_i)$. We assume that 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 $\bar{Y} = L + \int_i \pi_i(p_i)di + \int_i \tau_i m(p_i)di$ denote aggregate income, we can write welfare as $\bar{W} = \bar{Y} + \int_i s_i(p_i)di$, or equivalently:

$$\bar{W} = L + \int_i W_i di \qquad \text{where:} \qquad W_i \equiv s_i(p_i) + \pi_i(p_i) + \tau_i m_i(p_i) \tag{3}$$

In addition to the tariffs, there are two types of trade costs, red-tape barriers (RTBs), which are denoted θ_i, and "natural" trade costs δ_i. Focusing on the RTB first, for the present we assume that this generates no revenue or rents; in Section 5 we will allow for the possibility that RTBs may generate some rents. The natural trade costs δ_i are unaffected by trade policy but can be affected by exogenous technological improvements, so we will interpret a fall in the δ_i's as capturing "globalization." A major focus of the analysis will be how globalization impacts equilibrium trade policies. 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:

$$p_i = p_i^* + \delta_i + \tau_i + \theta_i \tag{4}$$

We now introduce the government's objective function. To capture the idea that the government chooses trade policy subject to domestic political pressures, we take a standard reduced-form approach and assume that the government maximizes the following politically-adjusted welfare function:

$$\bar{V} = L + \int_i V_i di \qquad \text{where:} \qquad V_i \equiv s_i(p_i) + (1 + \gamma_i)\pi_i(p_i) + \tau_i m_i(p_i) \tag{5}$$

The weight $\gamma_i > 0$ reflects the political influence of domestic producers of good i.[9] We assume that V_i is concave in τ_i.

Before we consider trade agreements, we focus on the noncooperative scenario, that is the

[9] This reduced-form approach is similar to Hillman (1982) and Baldwin (1987). A model that provides micro-foundations for this type of government objective is Grossman and Helpman (1994).

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. The first order condition that defines the optimal noncooperative tariff is

$$\frac{dV_i}{d\tau_i} = \gamma_i y_i + \tau_i m_i' = 0, \tag{6}$$

Condition (6) yields the optimal noncooperative tariff, which we label τ_i^N. This can be written in a familiar inverse-elasticity form:

$$\tau_i^N = -\frac{\gamma_i y_i}{m_i'} \quad \Rightarrow \quad \frac{\tau_i^N}{p_i} = \frac{y_i}{m_i}\frac{\gamma_i}{\varepsilon_i} \tag{7}$$

where $\varepsilon_i \equiv -\frac{p_i m_i'}{m_i}$ is the elasticity of import demand. Thus the optimal tariff is higher the smaller the import penetration rate m_i/y_i, the less elastic is import demand, and the greater the weight on producer surplus. We note that τ_i^N is prohibitive if γ_i is above some threshold level which we label γ_i^H.

3 Trade Agreements

To examine trade agreements, we now distinguish between an ex-ante stage in which the Home government can commit to a trade agreement, and an ex-post stage in which the government chooses trade policies subject to the constraints imposed by the trade agreement.

We assume that at the ex-ante stage the political weights γ_i are uncertain. 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 product characteristics (demand, supply, natural trade costs) 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 and of describing them in detail in the contract. The non-contractibility of RTBs implies that the agreement leaves *discretion* over RTBs to the home government. Since RTBs are not subject to the agreement, they can respond flexibly to the political pressures faced ex post by the government. Second, the agreement cannot specify fully-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). This means that the agreement also displays some *rigidity*.[10] The co-existence of rigidity and discretion in the trade agreement will be key to our theory. In particular, the model will allow for RTBs to emerge in equilibrium and will yield rich predictions regarding the extensive- and intensive-margin effects of RTBs and how these effects change with globalization.

We will examine the implications of a trade agreement in two steps. In subsection 3.1 we will take tariff commitments as exogenous, and highlight the implications of tariff reductions for the use of RTBs, as well as the impact of some key parameter changes (in particular, a decline in natural trade costs) when tariffs are held fixed. This will serve two purposes. First, this can be interpreted as a short-run analysis, to the extent that tariffs cannot be

[10]Horn 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. 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 exist ways to mitigate the problem of discretion over non-tariff policies, for example introducing a "non-violation" clause such as GATT's Article XXIII:1(b). Broadly speaking, this clause allows an exporting country to challenge any policy change applied by an importing country if it adversely impacts the volume of imports. An important limitation of such clause is that, if there are unobservable (or non-verifiable) shocks to trade volume, it can be hard to identify whether a reduction in import volume is caused by a particular policy change or by other shocks. Also, if the policy change itself is hard to observe or verify – as might be the case for subtle red-tape barriers – it is not easy for a country to challenge it by invoking such clause. To our knowledge, this clause has never been invoked to challenge red-tape barriers of the kind we focus on, in spite of their widespread use.

renegotiated frequently. Second, this can capture situations where a country does not have much choice on the tariff commitments, for example because it must choose whether or not to join a pre-existing trade agreement.

In subsection 3.2 we explicitly consider the formation of the trade agreement and examine the optimal tariff commitments, the resulting ex-post RTBs and the comparative-statics impact of some key model parameters. In this section we consider a domestic-commitment motivated trade agreement in a small country, but in a later section 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 (3)), but when choosing trade policies ex post it maximizes the politically-adjusted social welfare function (given by (5)). 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).

3.1 Exogenous Tariff Commitments

In this section we examine the government's ex-post choice of RTBs given an exogenous set of tariff commitments. Before we do this, however, it is instructive to focus on the benchmark case where the RTB is the only instrument available, e.g. because a trade agreement sets the tariffs at zero. In this case, we ask, when will the government impose RTBs?

Recall that 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:

$$\text{(i)}\ \frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i \qquad \text{(ii)}\ \frac{d^2V_i}{d\theta_i^2} = \gamma_i y_i' - m_i' > 0 \tag{8}$$

This implies a corner solution: the optimal θ_i is either zero or it chokes off trade for product i. 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:

$$V_i^{NT} > V_i^{FT} \quad \Leftrightarrow \quad \gamma_i > \gamma_i^L \equiv \frac{s_i^{FT} - s_i^{NT}}{\pi_i^{NT} - \pi_i^{FT}} - 1 \tag{9}$$

The condition in (9) means that γ_i is sufficiently high 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 $\gamma_i^L < \gamma_i^H$. For the analysis to be interesting, 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 no-tariff scenario considered here illustrates a simple but fundamental feature of the government's unilateral choice of wasteful trade barriers: if a trade barrier does not generate revenue, it may be politically optimal to use it if more efficient trade policies such as tariffs are not available, but then there is a fundamental source of non-convexity in the government optimization problem, due to the absence of revenue. This non-convexity 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 an arbitrary tariff commitment. Note that the benchmark case considered just above is a special case of this, where the tariff is constrained at zero.

Suppose that the tariff for product i is constrained at some level τ_i, 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: given the presence of a tariff, 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 (5) with respect to θ_i, allowing for a positive tariff:

$$\text{(i) } \frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i + \tau_i m_i' \qquad \text{(ii) } \frac{d^2V_i}{d\theta_i^2} = \gamma_i y_i' - m_i' + \tau_i m_i'' \tag{10}$$

As the expressions above make clear, if import demand m_i is convex, linear 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 may be concave in θ_i for a range of τ_i.

For the present, we assume that V_i is convex in θ_i for all τ_i, deferring until Section 4 the more general case in which V_i may be concave. The convex case is simpler and will allow us to make a number of key points.

In the convex case, the ex-post choice of θ_i exhibits a bang-bang pattern: it is either zero or prohibitive, depending on the 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 τ_i and γ_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.

Figure 1 illustrates the RTB response function for a given tariff level, with the realization of γ_i on the horizontal axis.

This in turn implies, from an ex-ante point of view, that lowering the tariff increases the probability that imports of product i are choked by red tape.

Consider next the impact of a general decrease in tariffs. We let F^{choke} denote the fraction of products whose imports are choked by red tape. As noted above, if τ_i falls, the probability that imports of product i get choked increases, so 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 dominance

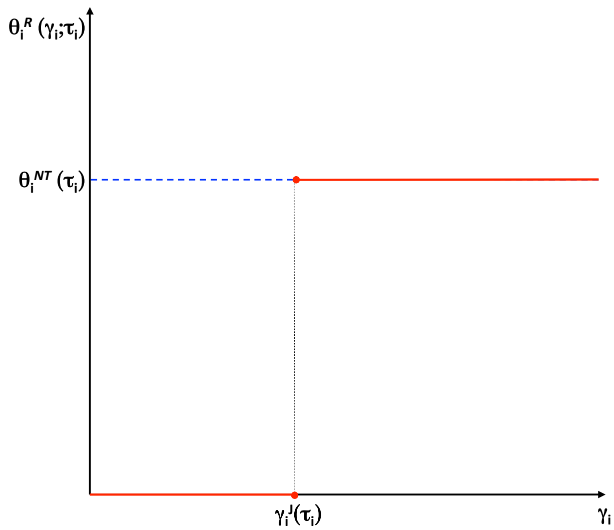

Figure 1: The RTB Response Function

sense. Thus, the RTB response to the tariff reduction causes a reduction of trade at the extensive margin.

The next proposition summarizes:

Proposition 1. *(i) 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 $\gamma_i < \gamma_i^J(\tau_i)$; (ii) The probability that imports of product i are choked by red tape increases as τ_i falls; (iii) If τ_i decreases for all products, F^{choke} increases in the first-order stochastic sense.*

Proposition 1(i) is intuitive, given that the objective function is convex in θ_i and hence the solution is 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. Proposition 1(ii) reflects a "policy substitution" effect: when the tariff is lower the government has more incentive, other things equal, to use red-tape barriers, and hence a smaller political weight is needed to convince the government to do it.[11] And Proposition 1(iii) is a direct implication of this substitution effect at the aggregate level.

[11]Policy-substitution effects have been highlighted in the literature for other non-tariff barriers. See, for example, Copeland (1990), Horn et al. (2010) , and Limão and Tovar (2011).

Note another interesting effect of tariff reductions: when we consider the joint effect of the tariff reductions and the induced RTB changes, trade increases at the intensive margin (because conditional on a product being imported, the tariff goes down and no RTB is imposed), but shrinks at the extensive margin (because the number of products choked by RTBs increases).

In light of the substitutability between tariffs and RTBs, one might think intuitively that a reduction in natural trade costs (δ_i) should induce the government to rely more on red-tape barriers. In fact, 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. This intuition turns out not to be correct.

The key is to observe that, for each product i, the threshold political weight γ_i^J increases as δ_i decreases. To see why, suppose the government is 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. An alternative perspective to understand this

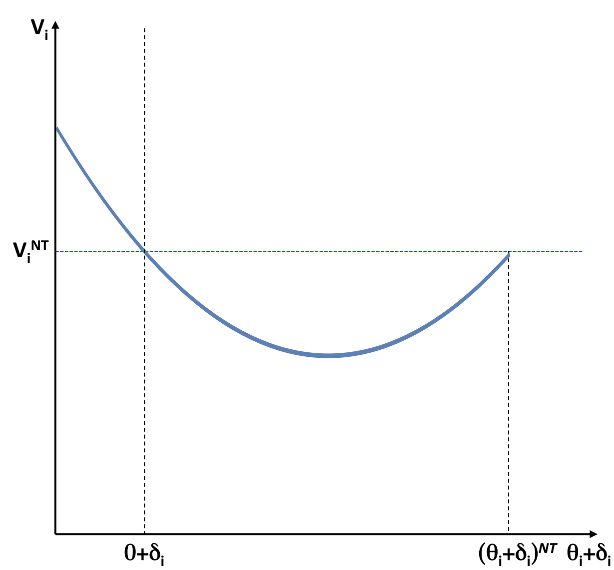

Figure 2: Globalization and the Threshold Value of γ

point 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 a corner solution, θ_i is complementary to δ_i.

Consider next the impact of a general fall in natural trade costs. 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* δ_i. *(ii) If* δ_i *falls for all products,* F^{choke} *decreases 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. Proposition 2(ii) suggests a "time-series" prediction of the model: globalization should lead to fewer RTBs, and through this channel, to an expansion of trade at the extensive margin.[12]

Why does the standard policy-substitution intuition fail in this setting? The fundamental reason is that the standard intuition applies to a world of interior solutions, but fails in this setting because the government's objective function is convex in the RTBs, and hence the optimal RTBs are always at a corner (zero or prohibitive), so all the "action" is at the extensive margin rather than at the intensive margin of trade.

We can conclude that, in this scenario where RTBs matter only at the extensive margin, if tariffs are held fixed, globalization induces the government to rely less on red-tape barriers.

[12] As for the case of tariff reductions, when we consider the joint effect of the reduction in natural trade costs and the induced RTB response, trade increases both at the extensive margin and at the intensive margin: for products that are RTB-free before and after the change, trade increases because δ_i decreases, and the fraction of products choked by RTBs decreases.

3.2 Optimal Tariff Commitments

In this section we consider the optimal trade agreement. 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 effectively 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 commitment product by product. Focusing on product i, the optimization problem can be written as follows:

$$\tau_i^B(\gamma_i^0) \equiv \arg\max_{\tau_i} W_i[\tau_i, \theta_i^R(\tau_i, \gamma_i^0)], \qquad \text{where} \qquad \theta_i^R(\tau, \gamma_i^0) \equiv \arg\max_{\theta_i} V_i(\tau_i, \theta_i, \gamma_i^0). \quad (11)$$

Recall from Proposition 1 that $\theta_i^R(\tau, \gamma_i)$ is prohibitive if $\gamma_i > \gamma_i^J(\tau_i)$, where $\gamma_i^J(\tau_i)$ is increasing in τ_i. It follows immediately that $\theta_i^R(\tau, \gamma_i)$ is prohibitive if $\tau_i < \tau_i^J(\gamma_i)$, where $\tau_i^J(\cdot)$ is the inverse of $\gamma_i^J(\cdot)$.

Given that the RTB is prohibitive (zero) if the tariff is below (above) the threshold $\tau_i^J(\gamma_i^0)$, it is easy to argue that the bespoke tariff $\tau_i^B(\gamma_i^0)$ is the lowest tariff that does not trigger RTBs, hence it coincides with $\tau_i^J(\gamma_i^0)$.[13] Figure 3 illustrates. Intuitively, the first-best trade agreement would specify zero trade barriers in this small open economy. However, since it is not possible to commit to this, the optimal trade agreement sets a tariff which is just high enough to avoid a "protectionist backlash" that would choke trade.

The next interesting question is how the bespoke tariff varies with the natural trade cost δ_i. Recall from the discussion following Proposition 2 that a decrease in δ_i reduces the

[13] This implicitly assumes 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 is "just" above $\tau_i^J(\gamma_i^0)$.

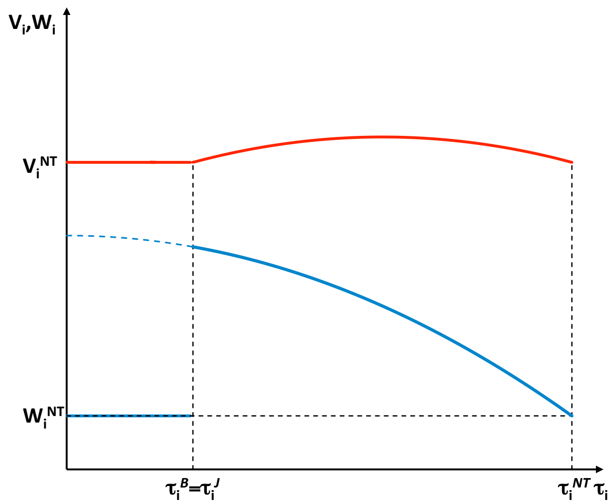

Figure 3: The Bespoke Tariff

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:

Remark 1. *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.*

As Proposition 1(i) highlights, in this benchmark case where tariffs can be perfectly tailored to the relevant economic and political parameters, no RTBs emerge in equilibrium. However, the *potential* for use of RTBs limits the extent of tariff liberalization: indeed, if RTBs were not available, the optimal trade agreement would lower tariffs all the way to zero; but given that RTBs are available, the optimal trade agreement sets strictly positive tariffs to prevent RTBs from emerging. This effect is similar to 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 other trade-distorting policies (in their model, production subsidies), if these are not specified in the agreement.

Proposition 1(ii) states that, in this scenario, globalization induces tariff liberalization:

as natural trade costs fall, the government is less tempted to use RTBs for given tariffs, so there is less need to keep tariffs high for "indirect incentive-management" purposes.

Now we introduce political uncertainty, by considering a non-degenerate distribution of γ_i for each product i (while keeping the assumption that tariffs cannot be contingent on the γ_i's). The optimal tariff, which we denote $\bar{\tau}_i$, maximizes expected welfare for product i:

$$\bar{\tau}_i \equiv \arg\max_{\tau_i} \int_{\gamma_i^{min}}^{\gamma_i^{max}} W_i(\tau_i, \theta_i^R(\tau_i;\gamma_i)) g_i(\gamma_i) \mathrm{d}\gamma_i. \tag{12}$$

We can write expected welfare from (12) as:

$$\int_{\gamma_i^{min}}^{\gamma_i^J(\tau_i)} W_i(\tau_i, 0)\, g_i(\gamma_i)\mathrm{d}\gamma_i \;+\; \int_{\gamma_i^J(\tau_i)}^{\gamma_i^{max}} W_i^{NT}\, g_i(\gamma_i)\mathrm{d}\gamma_i = G_i(\gamma_i^J(\tau_i))W_i(\tau_i) + [1 - G_i(\gamma_i^J(\tau_i))]W_i^{NT} \tag{13}$$

where W_i^{NT} denotes the no-trade welfare level for product i, which obtains if θ_i is prohibitive, and we adopt the convention that $\int_a^b(\cdot) = 0$ if $a > b$. When political pressure is relatively low, between γ_i^{min} and $\gamma_i^J(\tau_i)$, the product is imported at the tariff τ_i, but when political pressure is relatively high, between $\gamma_i^J(\tau_i)$ and γ_i^{max}, imports are choked by red tape, yielding the no-trade welfare level.

The first-order condition (FOC) for the optimal tariff is:

$$g_i(\gamma_i^J(\tau_i))\frac{d\gamma_i^J(\tau_i)}{d\tau_i}\Delta W_i(\tau_i) + G_i(\gamma_i^J(\tau_i))\frac{\partial W_i(\tau_i, 0)}{\partial \tau_i} = 0, \tag{14}$$

where:

$$\Delta W_i(\tau_i) \equiv W_i(\tau_i, 0) - W_i^{NT} \tag{15}$$

is the welfare loss caused by a prohibitive RTB relative to a zero RTB (for a given tariff).

The FOC above highlights the tradeoffs that play out 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 (14), 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.

Our first observation is that, even if it is possible to choose a tariff that prevents RTBs in any contingency, the optimal tariff will typically induce RTBs with positive probability in equilibrium. To see this, suppose $\gamma_i^{max} < \gamma_i^H$: in this case there is a non-prohibitive tariff that prevents RTBs from arising in any contingency, namely $\tau_i = \tau_i^J(\gamma_i^{max})$ (or any tariff higher than that). However, setting the tariff in this way will typically be suboptimal. Consider decreasing the tariff slightly below $\tau_i^J(\gamma_i^{max})$. This will have a cost and a benefit: the cost is that RTBs will be triggered for a small interval of γ_i, and the benefit is a small tariff reduction for almost the whole range of γ_i; thus, if the density at γ_i^{max} is not too high, the cost will be lower than the benefit, and hence the optimal tariff induces RTBs in equilibrium.

We next consider how the optimal tariff commitments and the induced RTBs are affected by changes in two key exogenous features of the environment: political uncertainty and natural trade costs.

We start by considering how the optimal tariff commitments are affected by changes in political uncertainty. We will show that, if we increase uncertainty in γ_i (in a sense that we will make precise in a moment), the optimal tariff for product i varies non-monotonically, first rising and then falling.

Let γ_i^{med} denote the median value of γ_i. We now introduce a definition that will be useful in our analysis: we say that the density function $g^a(x)$ features a *median-preserving local flattening* relative to $g^b(x)$ if the two distributions have the same median x^{med} and $g^a(x^{med}) < g^b(x^{med})$. A median-preserving local flattening simply means that the density is lowered locally around the median (recall g_i is assumed continuous), while preserving the median. Note, this is not meant to be a definition of an increase in uncertainty for general distributions.[14] However, for all common parametric distributions a median-preserving spread is equivalent to a median-preserving flattening: this is easy to check, for example, for the Pareto, normal, lognormal and uniform distributions. With this in mind, in what follows we will interpret a median-preserving flattening as an increase in uncertainty.

Now consider the effect of a median-preserving flattening in $g_i(\gamma_i)$ on the optimal tariff. Consider the left-hand side of (14) 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, as we flatten the distribution while preserving its median, 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 (14) 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 (14) is positive, thus the optimal tariff is above $\tau_i^J(\gamma_i^{med})$. Finally recall from Remark 1 that, if the distribution of γ_i is degenerate at γ_i^{med} – that is, if $g_i(\gamma_i^{med})$ is infinite – the optimal tariff is equal to $\tau_i^J(\gamma_i^{med})$. It follows that:

Proposition 3. *Starting at the degenerate distribution, the optimal tariff varies in a non-monotonic way with a median-preserving local flattening of $g_i(\gamma_i)$: it starts at $\tau_i^J(\gamma_i^{med})$, then rises above it, and eventually falls below it.*

Proposition 3 highlights an interesting non-monotonicity, which results from the subtle trade-offs in the choice of the optimal tariff commitment.

To gain some intuition, focus on the tariff level such that there is a 50-50 chance that RTBs will be triggered (call it $\tau_i^{med} \equiv \tau_i^J(\gamma_i^{med})$). If the distribution of γ_i is degenerate at the median, we are back in the bespoke tariff case considered earlier: the optimal tariff is *just* above τ_i^{med}, and RTBs are triggered with probability zero. Now consider a non-degenerate distribution of γ_i, but very concentrated around the same median: the infra-marginal effect of the tariff for the low range of γ_i where RTBs are not triggered (the second term in (14))

[14]Indeed, this would not be appropriate as a general definition of increase in uncertainty because it says nothing about how the distribution changes away from the median.

stays unchanged, while the impact of the tariff on the threshold γ_i^J above which RTBs are triggered (the first term in (14)) is positive and large, so the optimal tariff is discretely above τ_i^{med}. Finally, consider a distribution of γ_i that is very flat around the median: again, the infra-marginal effect of the tariff is unchanged, but now the impact of the tariff through the threshold γ_i^J is small, so the optimal tariff is below τ_i^{med}. Thus the optimal tariff first goes up and then goes down as we increase uncertainty in a median-preserving way.

This result suggests an interesting prediction: controlling for all other product characteristics, the optimal tariff commitment should be highest for products with intermediate degrees of political uncertainty.

Next we make an observation concerning the impact of political uncertainty on the equilibrium RTBs. We argued above that if $g_i(\gamma_i^{med})$ is sufficiently small then the optimal tariff is below $\tau_i^J(\gamma_i^{med})$, and if $g_i(\gamma_i^{med})$ is sufficiently high then 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 $\gamma_i^J(\tau_i) > \gamma_i^{med}$, which is the case if and only if imports of product i are choked by red tape with probability lower than 1/2. We can thus state:

Proposition 4. *If $g_i(\gamma_i^{med})$ is sufficiently high, the probability that imports of product i are choked by red tape is lower than 1/2. If $g_i(\gamma_i^{med})$ is sufficiently low, the probability that imports of product i are choked by red tape is higher than 1/2.*

As we discussed above, we can interpret the case in which $g_i(\gamma_i^{med})$ is high (low) as corresponding to the case of small (large) political uncertainty. Recall also from Remark 1 that, if there is no uncertainty at all ($g_i(\gamma_i^{med})$ is infinite), the optimal tariff always induces $\theta_i = 0$. Thus, the results of Remark 1 and Proposition 4 together suggest that more political uncertainty tends to induce more RTBs. This in turn suggests that, other things equal, RTBs should be more likely to arise for products characterized by more political uncertainty.

The intuition behind this prediction is simple: the "right" level of the tariff commitment is the one that just prevents RTBs from arising, and, since tariffs cannot be contingent on political shocks, increasing political uncertainty makes it harder to guess the right level of the tariff, thus causing "errors" and inducing RTBs in equilibrium.

Next we focus on the impact of natural trade costs on the optimal tariff commitments.

As usual we can focus on a single product, given the separability of the model. We have two results. The first one is that, if political uncertainty is sufficiently small, in the sense that the distribution of γ_i is sufficiently concentrated, then a fall in δ_i leads to a decrease in the optimal tariff. To see this, recall from Remark 1 that, if the distribution of γ_i is degenerate at some value γ_i^0, the optimal ("bespoke") tariff is increasing in δ_i. Intuitively, then, the optimal tariff is increasing in δ_i also if the distribution of γ_i is sufficiently concentrated.[15]

This result is interesting because it provides a possible theoretical explanation for the occurrence of gradual tariff liberalization as a result of "globalization." A reduction in natural trade costs may encourage tariff liberalization because – as highlighted by Proposition 2 – it reduces a government's incentive to use RTBs, and hence there is less need to keep tariffs high to keep this incentive in check.

While the model *can* explain gradual tariff liberalization as a result of globalization, it is interesting to observe that the impact of globalization on the optimal tariff may be reversed if political uncertainty is large enough. Consider how a fall in δ_i affects the first order condition (14). Reducing δ_i can affect (14) through multiple channels, so it easy to see why the overall effect can go either way. In particular, one of these effects is that reducing δ_i increases ΔW_i, the welfare loss from shutting down trade; this effect pushes in favor of a higher tariff. 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 if dispersion is sufficiently large.

We summarize the results just mentioned with the following:

Proposition 5. *If political uncertainty is sufficiently small, a fall in δ_i leads to a decrease in the optimal commitment tariff. However, this effect may be reversed if political uncertainty is sufficiently large.*

Before concluding this section, we note that our qualitative results would not be affected

[15] We prove this claim formally in the Appendix.

if the agreement specified tariff caps instead of exact tariff commitments (see also footnote 10). The main change would be that the government can choose both θ_i and τ_i (subject to the 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 is one additional term in the first order condition (14), corresponding to the range of γ_i where the tariff cap is not binding. As we show in the Appendix, this implies that the optimal tariff cap is higher than the optimal exact tariff commitment, but our results are not altered in a qualitative way.

4 RTBs and the Intensive Margin

In the setting we considered thus far, equilibrium RTBs affect only the extensive margin of trade. But under some conditions, they can also affect trade at the intensive margin.

As before, we can focus on a given product i. If the import demand for product i is sufficiently concave, then the RTB response $\theta_i^R(\tau_i, \gamma_i)$ is non-prohibitive for a range of τ_i and γ_i. To see this, recall $\frac{d^2 V_i}{d\theta_i^2}$ from equation (10): if m_i'' is negative, then increasing θ_i reduces tariff revenue at an increasing rate. If this effect is strong, V_i is concave in θ_i and a non-prohibitive value of the RTB may be optimal.

An example where $\theta_i^R(\tau_i, \gamma_i)$ is interior for a range of τ_i and γ_i is the case in which supply is fixed and the demand function takes the Pollak (1971) form, that is $x_i(p_i) = \alpha - \beta p_i^\sigma$, with σ sufficiently large.[16]

As in the previous section, we start by focusing on the case of exogenous tariff commitments, and characterize how the RTB response depends on tariffs and natural trade costs.

[16]Note that with a fixed supply $\frac{d^2 V_i}{d\theta_i^2}$ is independent of γ_i. Conditional on Pollak demands, a sufficient condition for $\frac{d^2 V_i}{d\theta_i^2} < 0$ is $\sigma > 2$.

4.1 Exogenous Tariff Commitments

As pointed out above, if import demand for product i is sufficiently concave, the RTB response may be non-prohibitive. Consider a fixed tariff and focus on how the optimal RTB depends on the realization of γ_i. Intuitively, θ_i^R can be non-prohibitive only for an intermediate interval of γ_i, because θ_i^R is zero if γ_i is very low and prohibitive if γ_i is very high. It is also clear 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. It can also be shown that θ_i^R must be continuous in γ_i except possibly at $\tilde{\gamma}_i(\tau_i)$.

Figure 4 illustrates the RTB response as a function of γ_i for a given tariff level, focusing on the case in which the non-prohibitive range $(\hat{\gamma}_i(\tau_i), \tilde{\gamma}_i(\tau_i))$ is non-empty and θ_i^R has a jump at $\tilde{\gamma}_i(\tau_i)$.

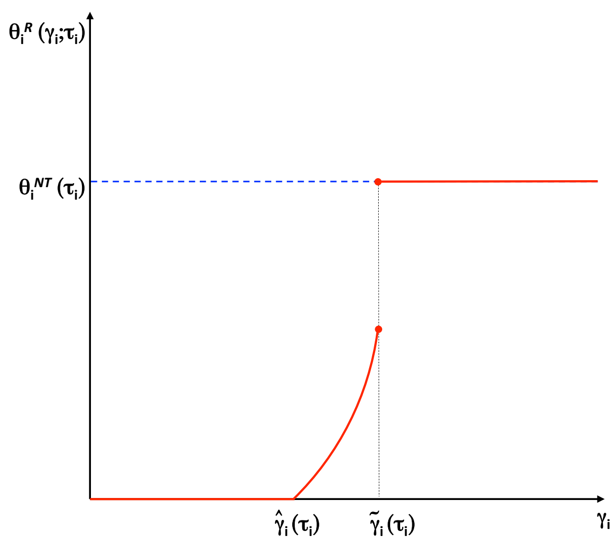

Figure 4: The RTB Response Function in the Non-Prohibitive Case

How do tariff levels affect RTBs? Let us focus first on the product level. It is easy to show that decreasing τ_i decreases both thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$, while increasing the level of θ_i^R in the non-prohibitive interval. As a consequence, decreasing τ_i increases the probability that product i is affected by RTBs, the expected level of RTBs, and the probability that imports of product i are choked by RTBs.

At the aggregate level, the above observations imply that a general reduction in tariffs increases the average level of non-prohibitive RTBs as well as the fraction of products that are choked by RTBs. The following proposition summarizes the relevant points:

Proposition 6. *(i) There exist $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$ 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 $\gamma_i > \tilde{\gamma}_i(\tau_i)$; (ii) $\theta_i^R(\gamma_i, \tau_i)$ is continuous except possibly at $\gamma_i = \tilde{\gamma}_i(\tau_i)$; (iii) Increasing τ_i reduces the probability that $\theta_i > 0$, the probability that θ_i chokes imports, and the expected level of θ_i; (iv) A general reduction in tariffs increases the average level of non-prohibitive RTBs as well as the fraction of products choked by RTBs.*

Note that, in this richer scenario, the RTB response induced by tariff reductions may affect trade both at the extensive margin (with more products choked by RTBs) and at the intensive margin (with RTBs partially offsetting the tariff reductions, conditional on non-prohibitive RTBs being used).

The "bang-bang" case examined in the previous section corresponds to the case where $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$ and hence the intermediate interval of γ_i is empty. As we now show, the effects of globalization on the equilibrium RTBs are dramatically different in the bang-bang case and in the case where $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$.

Let us start by considering a decrease in natural trade costs (holding tariffs fixed) at the product level. The key observation is that, if the RTB response is non-prohibitive for a non-empty interval of γ_i (that is $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$), a decrease in δ_i leads to a one-for-one increase in θ_i^R in the 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, red tape is used to neutralize the reduction in natural trade costs. And as a consequence of this, the lower threshold $\hat{\gamma}_i(\tau_i)$ decreases. Finally, the upper threshold $\tilde{\gamma}_i(\tau_i)$ is not affected because at this threshold, the optimal θ_i is interior, so the change in δ_i is fully offset by a change in θ_i and the value of the objective is not affected.[17]

The above observations have two immediate implications. First, conditional on the non-prohibitive interval of γ_i being non-empty ($\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$), a decrease in the natural trade cost weakly increases RTBs for all γ_i, but the probability of choking is not affected. Second, as the natural trade cost decreases, non-prohibitive RTBs 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.

Thus, for a given tariff, there are two intervals of δ_i (each of which may be empty): for a high interval of δ_i the RTB response is bang-bang, and globalization reduces the probability of RTBs (as highlighted in the previous section); for a low interval of δ_i, RTBs are non-prohibitive for a range of γ_i, and globalization leads to an increase in this range, while the probability of prohibitive RTBs stays unchanged. Figure 5 illustrates this result, assuming parameters are such that both intervals of δ_i are non-empty. The following proposition summarizes:

Proposition 7. *Suppose τ_i is fixed. As δ_i falls: (i) In the first phase θ_i is either zero or prohibitive, and the probability of choking decreases; (ii) In the second phase the probability of choking stays unchanged, but non-prohibitive RTBs emerge for a range of γ_i, with this range increasing as δ_i keeps falling. [Each phase may be empty.]*

Notice the non-monotonic effect of δ_i on the probability of RTBs at the product level: as δ_i falls, first the probability of RTBs decreases, but at some point it increases again.

We now focus on the effects of a general fall in natural trade costs (globalization) at the aggregate level. Given that products are heterogeneous (and the tariffs may vary across products), some of the products may be such that $\hat{\gamma}_i(\tau_i) = \tilde{\gamma}_i(\tau_i)$, so that Proposition 7(i) applies, and others may be such that $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$, so that Proposition 7(ii) applies. We let `E` denote the former set of products and `I` the latter. Of course, each of these sets may be empty, depending on parameters. Also, when we talk about a change in the fraction of

[17]If there is a jump at $\tilde{\gamma}_i(\tau_i)$, there are two maxima, an interior level and the prohibitive level. A change in δ_i does not affect the value of the objective either at the interior maximum (since it is fully offset by θ_i) or at the prohibitive level (since the no-trade value of the objective is independent of trade costs)

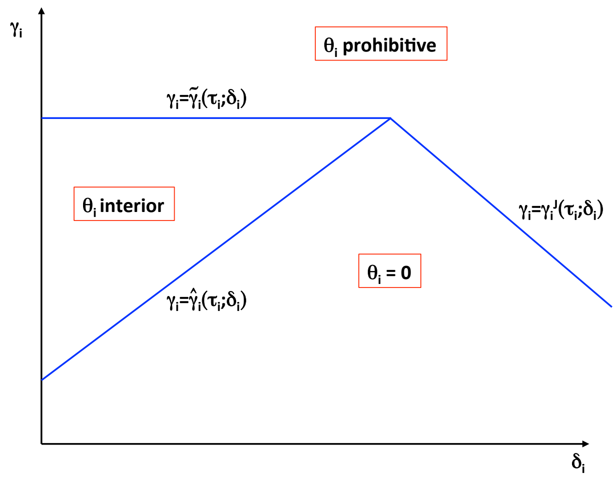

Figure 5: RTBs and Globalization in the Non-Prohibitive Case

products choked by RTBs, we mean it in the first-order stochastic sense (as in Proposition 2).

Corollary 1. *Holding tariffs fixed, globalization has the following effects: (i) Within product set* `E`*, trade expands at the extensive margin, due to fewer RTBs (the fraction of products choked by RTBs decreases). (ii) Within product set* `I`*, the extensive margin of trade is not affected (the fraction of products choked by RTBs is unchanged), but the average level of non-prohibitive RTBs increases. (iii) Set* `E` *shrinks (weakly) in favor of set* `I`*.*

Corollary 1 highlights one of the key insights of our model: globalization reduces RTBs when these operate at the extensive margin of trade, but increases RTBs when these operate at the intensive margin. In light of this, we refer to `E` as the "extensive-margin" product set and to `I` as the "intensive-margin" product set.

This result also suggests a couple of interesting predictions. First, 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). Second, the fraction of products choked by RTBs should *decrease* over time as natural trade costs fall. And finally, products characterized by lower natural trade costs should be less likely to be choked by RTBs.

4.2 Optimal Tariff Commitments

As in the previous section, we start with the benchmark case of no political uncertainty. We will characterize the optimal tariff commitments in this benchmark case (the "bespoke" tariffs) and how they change with globalization.

It is useful to start by examining how the RTB response $\theta_i^R(\gamma_i, \tau_i)$ varies with the tariff τ_i for a given γ_i. Recalling Proposition 6, 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: $\tau_i^B(\gamma_i^0) = \hat{\tau}_i(\gamma_i^0)$. The reason is that, in the range where θ_i^R is non-prohibitive, the derivative of θ_i^R with respect to τ_i is lower than -1, so the benefit of lowering the tariff is outweighed by the cost of the induced increase in θ_i^R. To understand why the RTB "over-responds" to changes in the tariff, start from a point on the RTB response function, where the FOC is satisfied ($\frac{dV_i}{d\theta_i} = \gamma_i y_i - m_i + \tau_i m_i' = 0$), 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 on $\frac{dV_i}{d\theta_i}$ due to the lack of revenue.

Next consider how the bespoke tariff varies with the natural trade cost δ_i. Recall that we defined `E` as the set of products such that the RTB response is bang-bang, that is $\tilde{\tau}_i(\gamma_i) = \hat{\tau}_i(\gamma_i)$ for all γ_i, and `I` as the set of products such that the RTB response may be non-prohibitive, that is $\tilde{\tau}_i(\gamma_i) < \hat{\tau}_i(\gamma_i)$ for some γ_i. Recall also from Remark 1 that, if the product is in set `E`, the bespoke tariff is increasing in δ_i. Next consider a product in set `I`. We just argued that in this case the bespoke tariff is $\hat{\tau}_i(\gamma_i^0)$. Recall from the discussion leading to Proposition 7 that $\hat{\gamma}_i(\tau_i)$ increases with δ_i for a given τ_i. This implies that $\hat{\tau}_i(\gamma_i)$ decreases with δ_i for a given γ_i. Thus globalization in this case *increases* the optimal tariff. The broad intuition is that, when RTBs operate at the intensive margin, globalization increases the government's incentive to use RTBs, and an increase in the tariff serves to mitigate this incentive.

We summarize the above discussion with:

Remark 2. *Suppose the distribution of γ_i is degenerate at γ_i^0: (i) The optimal commitment tariff (bespoke tariff) is the lowest tariff that does not trigger any red tape. (ii) If the product is in set* `I`*, the bespoke tariff is decreasing in δ_i. If the product is in set* `E`*, the bespoke tariff is increasing in δ_i.*

As Remark 2 indicates, the result that the bespoke tariff prevents any red tape from arising in equilibrium extends to the case in which RTBs operate at the intensive margin of trade. On the other hand, globalization has opposite impacts on the bespoke tariff depending on whether RTBs operate at the extensive margin or at the intensive margin.

We next consider the impact of globalization on the optimal tariffs in the presence of political uncertainty.

Recall from Proposition 5 that, conditional on a product being in set `E`, globalization reduces the optimal tariff 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 2(ii) suggests that, if political uncertainty is sufficiently small, globalization should increase the optimal tariff. We now show that this is actually true regardless of the degree of political uncertainty, that is for *any* distribution of γ_i.

We can write expected welfare as:

$$EW_i = \int_{\gamma_i^{min}}^{\hat{\gamma}_i(\tau_i)} W_i(\tau_i, 0) g_i(\gamma_i) \mathrm{d}\gamma_i + \int_{\hat{\gamma}_i}^{\tilde{\gamma}_i(\tau_i)} W_i(\tau_i, \theta_i^R(\gamma_i, \tau_i)) g_i(\gamma_i) \mathrm{d}\gamma_i + \int_{\tilde{\gamma}_i(\tau_i)}^{\gamma_i^{max}} W_i^{NT} g_i(\gamma_i) \mathrm{d}\gamma_i \tag{16}$$

We want to evaluate the cross derivative of (16) with respect to δ_i and τ_i. Consider first the first derivative with respect to δ_i. Recall that, when θ_i^R is non-prohibitive, a change in δ_i is exactly offset by a change in θ_i^R, thus leaving welfare unchanged, thus δ_i does not affect the second integrand. Also the no-trade level of welfare is unaffected by δ_i, so also the third integrand is unaffected by δ_i. Next note that we can ignore the effect of δ_i on the boundaries $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$, because welfare is continuous at the lower boundary, and the upper boundary is unaffected by δ_i. Thus the derivative of (16) with respect to δ_i is simply $G(\hat{\gamma}_i(\tau_i))\frac{\partial}{\partial \delta_i}W_i(\tau_i, 0)$. The cross-derivative of expected welfare with respect to δ_i and τ_i therefore is

$$\frac{\partial^2 EW_i}{\partial \delta_i \partial \tau_i} = G_i(\hat{\gamma}_i(\tau_i))\frac{\partial^2 W_i(\tau_i, 0)}{\partial \delta_i \partial \tau_i} + g_i(\hat{\gamma}_i(\tau_i))\hat{\gamma}_i'(\tau_i)\frac{\partial W_i(\tau_i, 0)}{\partial \delta_i} < 0, \tag{17}$$

where we have used the fact that $\frac{\partial^2 W_i(\tau_i,0)}{\partial \delta_i \partial \tau_i}$ has the same sign as m_i'', which recall is negative for products in set `I`, and that $\hat{\gamma}_i'(\tau_i) > 0$ (from Proposition 6). It follows that, conditional on the product being in set `I`, a small decrease in δ_i leads to an increase in the optimal tariff.[18] We thus can state:

Proposition 8. *Conditional on product i being in set* `I`*, the optimal commitment tariff is decreasing in* δ_i*, regardless of the distribution of* γ_i*.*

Our final comment concerns the impact of political uncertainty on the optimal tariffs. Recall from Proposition 3 that, when RTBs operate at the extensive margin (i.e. for products in set `E`), as political uncertainty increases from zero the optimal tariff first increases and then decreases. But when RTBs operate at the intensive margin (i.e. for products in set `I`), the model yields no sharp predictions. Thus, perhaps interestingly, while the predictions regarding the impact of globalization on the optimal tariffs are sharper for product set `I` than for product set `E` (see Proposition 8 vs Proposition 5), the opposite is true for the impact of political uncertainty on the optimal tariffs.

5 Partially Wasteful Trade Barriers

Until now, we have focused on RTBs which by definition do not generate any revenue. How much of our analysis continues to apply in the case of Non-Tariff Barriers (NTBs) which by

[18] Recall from the previous subsection that the tariff can affect whether the product is in set `I` or in set `E`. This is why our result is local, and we need the qualification "conditional on the product being in set `I`".

contrast may generate some revenue? To explore this, let us revisit the case of a small Home country which signs a trade agreement for commitment motives as in sections 3 and 4 with the assumption that a fraction $\phi_i > 0$ of the rents associated with the non-tariff 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 when ϕ equals one.

The per-good government's objective function now becomes

$$V_i \equiv s_i(p_i) + (1+\gamma_i)\pi_i(p_i) + [\tau_i + (1-\phi_i)\theta_i]m_i \tag{18}$$

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 the import tariff and so in the absence of restrictions on tariffs, the government would not use the NTB. However, as argued previously, if the use of tariffs is constrained by a trade agreement, then it may become optimal to use the NTB. Notice that the fact that the NTB now generates some revenue makes it more likely that V_i is concave in θ_i.

$$\frac{d^2V_i}{d\theta_i^2} = \gamma y_i' + (1-2\phi_i)m_i' + (\tau_i + (1-\phi_i)\theta_i)m_i'' \tag{19}$$

For simplicity, in this section, we focus on the case of linear demand and fixed supply where equation (19) becomes $\frac{d^2V}{d\theta_i^2} = (1-2\phi)m'$. With $\phi_i = 1$, as we have already argued in Section 3, V_i is convex in θ_i. Notice that this continues to be the case for any $\phi_i > 1/2$. And so for any NTB that generates less than 50 percent of the revenue of its tariff equivalent, all our results from Section 3 continue to hold.

On the other hand, when the NTB is not very wasteful, $\phi_i < 1/2$, the government's objective function V_i becomes concave in θ_i. In this case, similarly to Section 4.1, the NTB response will be non-prohibitive for an intermediate interval of γ_i (θ_i^R is zero if γ_i is very low and prohibitive if γ_i is very high). Thus, there will again be two thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$, $\hat{\gamma}_i(\tau_i) < \tilde{\gamma}_i(\tau_i)$, between which θ_i^R is non-prohibitive and increasing in γ_i. The NTB response function has thus the same properties as given in Proposition 6.

Interestingly however, the NTB response function for the case of partially wasted revenue has very different properties with respect to changes in natural trade costs relative to those described in Section 4. As we show in the Appendix, both thresholds $\hat{\gamma}_i(\tau_i)$ and $\tilde{\gamma}_i(\tau_i)$ are decreasing in δ_i and so a reduction in δ_i decreases both the probability of choking and also the probability of non-prohibitive NTBs. In other words, partially wasteful NTBs and natural trade costs are complementary. To see this, notice that

$$\frac{d^2V_i}{d\delta_i d\theta_i} = \gamma y_i' - \phi_i m_i' + (\tau_i + (1-\phi_i)\theta_i)m_i'' = \frac{d^2V_i}{d\theta_i^2} - (1-\phi_i)m_i' \tag{20}$$

and so when $\phi_i > 0$, $\frac{d^2V_i}{d\delta_i d\theta_i} > \frac{d^2V_i}{d\theta_i^2}$. In particular, with linear demand and fixed supply, $\frac{d^2V_i}{d\delta_i d\theta_i} = -\phi_i m_i' > 0$.

Thus, even though NTBs might be non-prohibitive for $\phi_i < 1/2$, their comparative statics properties with respect to natural trade costs are the same as those of prohibitive RTBs. This shows that the main results derived in Section 3 are not an artefact of the assumption of fully wasted revenue ($\phi_i = 1$).[19]

A further prediction of our model is that, as ϕ_i rises, the optimal NTB can switch from an interior solution to a corner solution, but not vice-versa. So 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.

6 Terms-of-Trade Motivated Trade Agreements

So far we have focused on domestic commitment as the motivation for a trade agreement. However, as we show in this section, the same qualitative insights hold when trade agreements

[19] On the other hand, recall from Section 4 that if $\phi_i = 1$ and the optimal RTB is non-prohibitive (which can happen if import demand is very concave), RTBs and natural trade costs are substitutes. Thus the result that RTBs and natural trade costs are substitutes if and only if the optimal RTB is non-prohibitive does not hold if $\phi_i < 1$.

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. Home is the natural importer of all non-numeraire goods, and can use both tariffs and RTBs, whereas the Foreign government is passive. For simplicity we return to the case of totally wasteful RTBs ($\phi_i = 1$).

Here we abstract from domestic commitment motives, so we assume that each government's objective is the same at the ex-ante stage (when the agreement is signed), and at the ex-post stage (when RTBs are chosen). In particular, the Home government's payoff is $V_i = s_i + (1+\gamma_i)\pi_i + \tau_i m_i$, as before, and the Foreign government's payoff is $V_i^* = s_i^* + (1+\gamma_i^*)\pi_i^*$.

In the absence of trade agreements, the Home government would again use only import tariffs, since they are a more efficient instrument than RTBs. However, when import tariffs are restricted by a trade agreement, it may become optimal to use RTBs.

To simplify the exposition we assume in this section that γ_i and γ_i^* are deterministic. Let us first explore the optimal choice of RTBs when tariff commitments are exogenously given. Similarly to the case of a small country with commitment motives, when τ_i is close to the non-cooperative tariff τ_i^N, the optimal RTB is zero, but as the tariff decreases, it may become optimal to impose a positive RTB. There will be again two tariff thresholds $\hat{\tau}_i(\gamma_i)$ and $\tilde{\tau}_i(\gamma_i)$, with $\tilde{\tau}_i(\gamma_i) \leq \hat{\tau}_i(\gamma_i)$, such that: for $\tau_i \geq \hat{\tau}_i(\gamma_i)$, the optimal RTB is zero; for $\tau_i \leq \tilde{\tau}_i(\gamma_i)$, the optimal RTB is prohibitive; and for $\tau_i \in (\tilde{\tau}_i(\gamma_i), \hat{\tau}_i(\gamma_i))$, the optimal RTB is positive but non-prohibitive. If V_i is convex in θ_i then $\tilde{\tau}_i(\gamma_i) = \hat{\tau}_i(\gamma_i) = \tau_i^J(\gamma_i)$ and the optimal RTB response function is bang-bang as in Section 3.

It can be easily shown that the thresholds $\tilde{\tau}_i$ and $\hat{\tau}_i$ vary with the natural trade cost δ_i in the same way as discussed in Sections 3 and 4, thus the impact of natural trade costs on RTBs for given tariff commitments is qualitatively similar as in our basic model.

Next we focus on the optimal choice of tariff commitments. We assume that the trade agreement maximizes the governments' joint payoff, $\Omega = V + V^*$. The implicit assumption is that efficient international transfers are available, so the nature of the agreement is that the Foreign government compensates the Home government for choosing the policies that maximize the joint payoff. As before, we assume that the agreement can only specify tariffs, while RTBs are chosen unilaterally by the Home government ex-post. Recall that in the case of a small country making an ex-ante commitment to maximize welfare, the government would commit to zero tariffs if RTBs were not available; but given that RTBs are available (and non-contractible), the tariff needs to be kept sufficiently high to prevent the use of RTBs ex post. A similar issue arises in the case of TOT-motivated trade agreement, with some qualifications.

If RTBs were not available, the agreement would specify the "first best" tariffs τ_i^{fb}, defined as the ones that maximize Ω. For each product i, the first best tariff τ_i^{fb} increases with γ_i and decreases with γ_i^*, and it is always such that $\tau_i^{fb}(\gamma_i, \gamma_i^*) < \tau_i^N(\gamma_i)$.

Let us first focus on the case where the RTB response function is bang-bang, that is $\tilde{\tau}_i(\gamma_i) = \hat{\tau}_i(\gamma_i) = \tau_i^J(\gamma_i)$. If $\tau_i^{fb}(\gamma_i, \gamma_i^*) > \tau_i^J(\gamma_i)$ then the government can set the tariff at the first-best level τ_i^{fb} without triggering RTBs ex post, and hence the availability of RTBs does not pose any concerns. If however $\tau_i^{fb}(\gamma_i, \gamma_i^*) < \tau_i^J(\gamma_i)$ then the first-best tariff level would trigger a prohibitive RTB ex post, and so the optimal tariff level is $\tau_i^J(\gamma_i)$. In the former case, the possibility of RTBs is essentially immaterial, so we will focus on the latter case, which seems empirically more relevant.

How does globalization affect the optimal tariffs in the bang-bang case? Recall from the discussion above that τ_i^J goes down as δ_i falls. Therefore globalization leads to tariff liberalization, just as in the case of no political uncertainty in our basic model.

Let us now focus on the case where the RTB response is non-prohibitive for a non-empty range of tariffs. In this case, if $\tau_i^{fb}(\gamma_i, \gamma_i^*) > \hat{\tau}_i(\gamma_i)$, the optimal tariff can be set at the first-level without triggering any RTBs, so RTBs pose no concerns. If $\tau_i^{fb}(\gamma_i, \gamma_i^*) < \hat{\tau}_i(\gamma_i)$, on the other hand, the optimal tariff is $\hat{\tau}_i(\gamma_i)$, that is the lowest tariff that does not trigger any RTBs. To see this, notice that when θ_i^R is non-prohibitive,

$$\frac{d\Omega}{d\tau_i} = \Omega_{\tau_i} + \Omega_{\theta_i}\frac{d\theta_i^R}{d\tau_i} = \Omega_{\tau_i} + (\Omega_{\tau_i} - m_i)\frac{d\theta_i^R}{d\tau_i} \tag{21}$$

$$= \Omega_{\tau_i}\left(1 + \frac{d\theta_i^R}{d\tau_i}\right) - m_i\frac{d\theta_i^R}{d\tau_i} > 0 \tag{22}$$

because $\frac{d\theta_i^R}{d\tau_i} = -\frac{V_{\theta_i\tau_i}}{V_{\theta_i\theta_i}} < -1$ and $\Omega_{\tau_i} < 0$.

Finally, it can be shown that $\hat{\tau}_i(\gamma_i)$ increases as δ_i falls, so when the optimal RTB is non-prohibitive for a non-empty range of tariffs, globalization raises the optimal tariff, just as in our basic model.

The bottomline of this section is that, conditional on RTBs mattering, the qualitative results of our basic model continue to hold.

7 Conclusion

Red-tape barriers to trade are pervasive but have received relatively 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. Politically-motivated governments may have incentives to impose RTBs, despite the fact that they yield no revenue, if a trade agreement can constrain tariffs but not RTBs. 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" that entails a resort to RTBs. However, RTBs may nonetheless emerge in equilibrium, if the tariff commitments are not fully contingent. When RTBs are used, they are likely to "choke" trade in some goods, implying that the extensive margin is key for understanding the impact of RTBs; but non-prohibitive RTBs can also arise if import demand is sufficiently concave. Whether or not RTBs are prohibitive 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.

While this paper is the first to consider the implications of red-tape barriers for international trade agreements, it is unlikely to be the last. There are many directions in which our approach should be extended. In particular, it is desirable to extend our analysis to imperfect competition, which would make it possible to investigate the implications of firm-specific RTBs and firm-specific political pressures. Another important direction for future work is to consider the implications of trade facilitation: what if governments can reduce natural trade costs by making costly investments? Finally, our model makes a number of testable predictions which should be subject to empirical investigation.

Appendices

To be added

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