WORKING PAPERS

N° 1131

April 2023

"Protection without Discrimination"

Vincent Rebeyrol

Toulouse School of Economics

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Vincent REBEYROL†

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Abstract

This paper shows that Non-Tariff Measures (NTMs) may fully respect the non-discrimination principle of the WTO and still act as a protectionist device. NTMs that raise the costs of all firms induce some exit and thus reallocate market shares towards the most efficient firms. The paper analyzes when this mechanism generates protectionism. Introducing political economy motives in the model, this paper shows that trade liberalization increases the use of NTMs in the non-cooperative equilibrium. Moreover, a trade agreement may be welfare reducing if governments only care about the most efficient firms. A Pareto improving trade agreement may require an international income redistribution between countries if the firm productivity distribution differs across countries. These results may help explaining why recent trade negotiations face increasing opposition.

Keywords: Trade protection, Non-discrimination, WTO, domestic regulations

J.E.L: F02, F12, F13

*I am grateful to the Editor Francesco Lippi and four referees, as well as Nicolas Berman, Thomas Chaney, Aksel Erbahar, Laura Hering, Sacha Kapoor, Yassine Lefouili, Mathieu Parenti, Gonzague Vannoorenberghe and Julien Vauday for helpful comments and suggestions at different stages of this paper. I also thank seminar and conference participants at Erasmus School of Economics, Transpyrenean Macro workshop TSE, HSE St Petersburg, INRA Rennes, ETSG Warsaw and Max Weber conference at EUI. I acknowledge funding from ANR under grant ANR-17-EURE-0010 (Investissements d'Avenir program).

†Toulouse School of Economics, University of Toulouse Capitole, Toulouse, France. vincent.rebeyrol@tse-fr.eu

1 Introduction

In the last decades, tariffs have been reduced to historically low levels through the succession of multilateral negotiation rounds at the GATT/WTO. These negotiations have been based on two key principles: non-discrimination and reciprocity.[1] The focus in trade negotiations has now shifted towards the increasing prevalence of Non-Tariff Measures (NTMs), in particular those related to domestic regulations and standards.[2] These NTMs have many legitimate motives, such as the need of protecting public health and the environment, providing relevant product information to consumers, or fitting local preferences. However, they also generate adaptation costs for firms. These additional costs imply two main trade related issues. First, NTMs could be used as protectionist instruments. While officially set up for legitimate objectives, they may be designed to be easier to deal with for domestic producers, granting them a competitive advantage over their foreign competitors.[3] Second, even if NTMs do not affect relative market shares, an international inefficiency may still arise. A Government choosing the level of its NTMs should balance consumers' interests with the additional costs for domestic firms. It has however no reason to take into account the negative impact on foreign firms, leading NTMs to be too stringent from a global perspective.

To deal with these issues, the WTO has agreements on technical barriers to trade (TBTs) and sanitary and phyto-sanitary (SPS) measures, which allow countries to set their own domestic regulations and standards if they fully respect the non-discrimination principle. The aim is to avoid the possibility of using them as protectionist instruments. These agreements also promote the use of international standards, with the objective of mitigating the potential global inefficiency problem. As explained below, the literature has shown in several ways that the inefficiency problem is likely to remain with these rules. A deep trade agreement coordinating NTMs is thus necessary. However, a full application of the non-discrimination principle (when possible) should eliminate the protectionist incentives behind these NTMs.

The main contribution of this paper is to show that the non-discrimination principle cannot prevent the use of NTMs as protectionist instruments. Therefore, NTMs may be diverted from their official welfare enhancing objectives and used as protectionist devices, while fully

[1] The non-discrimination principle requires countries to apply the same trade policies to foreign firms, no matter their country of origin (most favored nation) and to apply the same domestic policies to domestic and foreign firms (national treatment). The principle of reciprocity requires countries to exchange "equivalent concessions" in access to foreign markets, through reciprocal reduction of tariffs and/or removal of trade barriers.

[2] According to the 2012 World Trade report, the number of new Sanitary and Phyto-Sanitary (SPS) notifications per year was around 200 in 1995 and around 1100 in 2010. The number of Technical Barriers to Trade (TBT) notifications per year was less than 200 in 1995 and around 1500 in 2010. In both cases, the number of specific trade concerns raised at the WTO increased over time.

[3] Trade protection is usually broadly defined as "government action (or inaction) that effectively discriminates in favor of home producers against foreign producers" (Anderson, 2013).

respecting the principle of non-discrimination.[4] Moreover, the principle of reciprocity may not ensure a Pareto improving trade agreement on these NTMs in this situation.

The reason behind this result is that the non-discriminatory principle being defined at the micro level, it is not immune to distortions at the macro level. Suppose that an NTM raises production costs by the same amount for all operating firms in the local market. It forces the least efficient domestic and foreign firms to exit, which increases the market shares of surviving firms. In the aggregate, this market share reallocation can generate protectionism if it forces relatively more foreign firms to exit, or if domestic firms are relatively more efficient. This simple mechanism has been studied in the literature, addressing other issues.[5] This paper is however the first to consider it as a protectionist mechanism and addresses how it challenges the key principles of the WTO.

We consider a standard two-country two-sector heterogeneous firm trade model. The manufacturing sector is subject to monopolistic competition with CES preferences, and the distribution of firms is Pareto. In the baseline model, countries are symmetric and there is a fixed measure of firms and thus profits in equilibrium, as in Chaney (2008). To operate, firms first need to pay a fixed cost to set up their production facility. Firms also need to pay fixed costs specific to each market they want to serve, capturing the cost of distribution and meeting regulations and standards in place. The non-manufacturing sector absorbs all trade imbalances, wages are thus constant. We assume that governments have signed a shallow trade agreement in the spirit of the WTO. They thus do not have access to discriminatory policy instruments, such as tariffs. Governments can only, but freely, choose local regulations and standards (i.e. NTMs) provided that they are non-discriminatory.[6] An NTM increases the fixed costs specific to the local market by the same amount for all operating firms.[7] When production plus domestic specific fixed costs are larger than the market specific export fixed costs, an NTM induces a relatively larger exit of foreign firms, implying an aggregate profit shifting towards the domestic industry. As fixed costs determine (average) firm size, this situation arises when domestic firms are on average larger than foreign firms in the domestic market.[8] Intuitively, exporters are

[4]This paper thus rather proposes an outcome-based definition of protectionism: any policy that improves the relative market share of domestic firms should be considered protectionist.

[5]Most notably, it is at the roots of "raising rivals' costs" strategies (Salop and Scheffman (1983), Rogerson (1984)).

[6]We thus also abstract from the use of labor taxes/subsidies, as they would only apply to domestic producers. See Campolmi et al. (2022) for an analysis of the limits of shallow trade agreements when countries can still choose these labor taxes/subsidies.

[7]The empirical literature strongly suggests that domestic regulations and standards increase fixed costs, see section 2.

[8]This also implies that exporters sell more domestically than abroad. This is a solid empirical regularity. For example, Eaton et al. (2011) show that the export intensity, by export market, rarely exceed 0.1 for French exporters.

less inclined than domestic firms to pay an additional cost for a market that is, for them, less important.

Two alternatives to the baseline model are developed in the appendix. With free entry, an NTM increases entry in the domestic market and reduces it in the foreign market. It thus generates qualitatively the same effects as in Ossa (2011) with tariffs, but here with a non-discriminatory policy instrument.[9] In a one sector version of the model where wages are thus endogenous, an NTM induces an increase in relative wages, i.e. a terms of trade improvement. Hence, an NTM always improves the relative market share of domestic firms in the domestic market, which translates into larger profits, more entrants or higher wages, depending on the setup considered.

In all these cases however, the overall effect of NTMs is not welfare improving due to the exit of firms. One possibility is to follow the dominant approach in the literature and assume that NTMs have direct positive welfare effects, and thus have legitimate motives to be implemented.[10] In this case, the protectionist effect of NTMs induces governments to choose too stringent NTMs compared to the first best.[11] However, we follow another option in the main text as our mechanism emphasizes a major role for producers' interests. We introduce political economy motives in the objective function of the government. With no welfare improving effect of NTMs, the unique reason behind their implementation is the protectionist motive. Moreover, this allows to discuss the possible bias of the government towards some firms and its consequences for the outcome of a deep trade agreement.[12]

Governments thus balance the welfare loss due to less varieties available with the income gains by the domestic industry in the local market. In the non-cooperative equilibrium, each country may implement some NTMs for protectionist purposes. Countries are therefore trapped in a prisoner's dilemma and the non-discrimination principle cannot preclude this situation. Moreover, a decrease in trade costs increases the equilibrium level of NTMs, as its protectionist effect becomes more effective when the economy is more open. This means that a local industry facing more competition from abroad may ask to be taxed more, not less. This result may help explaining the rise in NTMs observed over the last decades and support the view that this rise is, at least partly, driven by protectionist motives.

[9] In the literature, this is often referred to as a delocation effect (see for example Ossa (2011), Grossman et al. (2021)). In a model with homogenous firms, this effect can indeed be fully interpereted as movements of firms across countries. This is no more the case with heterogenous firms, as firms exiting one market do not have the same productivity as entrants in the other market.

[10] See for example Costinot (2008), Staiger and Sykes (2011), Mei (2021), Maggi and Ossa (2020).

[11] We show this result in appendix C.

[12] This also allows us to consider horizontal and vertical standards indifferently, as we do not need to decide how NTMs should enter the utility function, which would depend on the externality NTMs are supposed to solve, e.g. do they address pollution concerns or taste divergence between countries?

Nevertheless, the principle of reciprocity allows negotiations on a deep trade agreement to reach an efficient outcome. Countries can exchange reductions in NTMs, which would result in equal exchanges of profits and welfare gains in both countries. This result however only holds if governments care about their entire domestic industry. If they care about the most efficient firms only, a trade agreement may be welfare reducing, because these firms benefit from NTMs in the other country. This result also does not hold when comparing asymmetric countries. To highlight this point, we next introduce an asymmetry in the firm productivity distribution across countries. In this case, one country may run a non-discriminatory protectionist policy because it hosts relatively more of the most efficient firms. But this cannot be the case for the other country, as NTMs would shift profits away from its industry. In this situation, a deep trade agreement can still be Pareto improving. However, such a trade agreement requires an unequal exchange of profits and thus an international income redistribution from the high to the low productivity country. This contradicts the reciprocity principle and casts doubt on the desirability of implementing international standards. More generally, this result may illustrate why recent trade negotiations at the WTO have proven difficult, with complaints from developing countries about stringent regulations that restrict access to developed countries markets.

This paper directly relates to the literature on regulatory protectionism. When tariff manipulations are restricted by trade agreements, countries may design domestic regulations and standards to provide an advantage for domestic firms over foreign ones.[13] This discrimination may be clear or hidden: NTMs may be non-discriminatory, but still harder to comply with for foreign firms (see Sykes (1999)). Grossman et al. (2021) analyze the delocation motive with standards in a model where preferences are heterogeneous across countries. They show that national treatment does not fully prevent the use of standards to attract foreign firms, because domestic standards are costlier for foreign firms as they have tailored their products to their local market preferences. Preferences heterogeneity thus prevents the non-discrimination principle to be fully effective.[14]

Trade agreements have also been analyzed when standards and regulations are fully equally costly for all firms. A first contribution is Costinot (2008) who analyzes the possibility of profit shifting in a duopoly model with standards. Staiger and Sykes (2011) extend Bagwell and Staiger (2001) and show in a perfectly competitive setting the incentive to improve the terms of trade with standards. Mei (2021) extends the Krugman model of Ossa (2011) to standards and

[13] See for example Fischer and Serra (2000), Baldwin (2000), Suwa Eisenmann and Verdier (2002).

[14] See also Parenti and Vannoorenberghe (2021) who develop a Ricardian model with Bertrand competition to analyze deep trade integration under preferences heterogeneity.

calibrates it to estimate the welfare loss when governments use standards to delocate firms to the domestic market. In all these papers, governments want to use discriminatory standards to run protectionist policies. But when national treatment is enforced, discrimination is no more possible and the protectionist motive disappears; in these papers, non-discriminatory standards do not improve the relative market share of domestic firms. They all show that the outcome is however still globally inefficient. Governments use non-discriminatory standards to reduce a negative externality, but do not internalize the effect of their policy on foreign firms. Hence, even if relative market shares are not altered and there is thus no protection, NTMs are too stringent compared to what would be optimal at the world level. In contrast, this paper proposes a new mechanism implying that the use of standards for protectionist reasons is still possible under national treatment. Moreover, this macro distortion is the only international inefficiency. If standards do not affect aggregate market shares between domestic and foreign firms, NTMs only reallocate profits from the least to the most efficient firms and are internationally neutral. This highlights that, when firm hetereogeneity is taken into account, the use of NTMs does not necessarily generate a global inefficiency.

Finally, this paper also relates to Maggi and Ossa (2020) who focus on the political economy of deep trade agreements under perfect competition. They show that trade agreements on product standards can decrease welfare when governments' decisions are influenced by producer lobbies, because these lobbies have internationally aligned interests. This paper extends their result in an imperfect competition setting, but with a condition. Here, lobbies' interests may or may not be aligned internationally, depending on the identity of the firms that are organized. The mechanism we put forward in this paper implies that the most efficient firms have aligned interests worldwide. If they are the only ones organized, as the literature suggests (e.g. Bombardini (2008), Blanga-Gubbay et al. (2020)), a deep trade agreement can be welfare reducing because governments decisions are shaped by the interests of the firms that also benefit from NTMs in their export markets. This echoes Rodrik (2018), who suggests that recent trade agreements over regulatory rules may be shaped by the rent-seeking behavior of large exporters.

2 The baseline model

2.1 Economic environment

We consider a simple heterogeneous firm trade model in the line of Chaney (2008), with two symmetric countries, Home (H) and Foreign (F). Without loss of generality, we focus on the Home perspective. Each economy is composed of two sectors: M and A. Sector M is the man-

ufacturing sector subject to CES monopolistic competition. Sector A produces a homogeneous good under perfect competition and constant returns to scale, and serves as a numeraire. Labor (L) is the only factor of production. Firms are owned by domestic agents.

Consumers.

Consumers have quasi-linear preferences, with a CES sub-utility function over the continuum of manufacturing varieties:[15]

$$U = A + \mu \ln C_M \qquad C_M = \left(\int c_i^{1-\frac{1}{\sigma}} \right)^{\frac{1}{1-\frac{1}{\sigma}}} \text{, with } \sigma > 1 \tag{1}$$

C_M and A denote consumption for the M composite good and the numeraire good, respectively. σ is the constant elasticity of substitution between any two varieties and μ the preference parameter over manufactured goods. Without loss of generality, we normalize the mass of consumers/workers to $L = 1$.

Firms.

The numeraire good (A) is produced with one unit of labor per unit of output and the wage rate is normalized to 1. We assume that μ is sufficiently small such that both countries produce good A. This good is freely traded between countries, ensuring factor price equalization.

Differentiated varieties in the manufacturing sector are produced at constant marginal production cost by heterogeneous firms. Given the CES preferences, the optimal price charged by firm i is a constant mark-up over its marginal cost: $p_i = \frac{\sigma}{\sigma-1} a_i$. In order to operate, firms need to pay two types of fixed production costs. First, firms have to pay F_P, the cost of setting up their production facility. Second, firms have to pay fixed costs associated with each market, that capture the cost of distribution and the cost of adapting the product to the standards and regulations in place. We label these fixed costs F_d for the domestic market and F_x for the export market. Finally, exporting goods to the other country is subject to an exogenous iceberg variable trade cost τ.

Given that marginal costs are constant and markets are segmented, firms maximize profits in each market independently. As in the literature, we assume that there is selection in the export market, i.e. only a subset of domestic firms choose to export. Hence, firms only serving their domestic market need to pay a total fixed cost of $F_P + F_d$. Those choosing to also export need to pay the additional fixed cost F_x. We make the standard assumption that $F_d + F_P < F_x \tau^{\sigma-1}$, ensuring that only the most productive firms choose to export.[16] To alleviate notations, we label

[15] The use of a quasi-linear utility function is motivated by the introduction of political economy motives for protection within this single manufacturing sector economy. The market outcome would not be qualitatively different with homothetic preferences. This extension is available upon request.

[16] This assumption implies that $F_d + F_P < (F_x + F_P)\, \tau^{\sigma-1}$, ensuring that no firm would find profitable to pay

$F = F_P + F_d$, the total amount of fixed costs any firm has to pay to operate in its domestic market. We refer to the profits of a Home firm i in its domestic (Home) market as π_{HH}; we use the first subscript for the firm location and the second for the destination market. Profits are thus given by:

$$\pi_{HH}(a_i) = \frac{\mu}{\sigma} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} a_i^{1-\sigma} - F \tag{2}$$

where $P_H = \left(\int_{i\in\Theta} p_i^{1-\sigma} di\right)^{\frac{1}{1-\sigma}}$ is the perfect price index at Home. Profits of a Foreign firm i exporting to the Home market are:

$$\pi_{FH}(a_i) = \frac{\mu}{\sigma} P_H^{\sigma-1} \tau^{1-\sigma} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} a_i^{1-\sigma} - F_x \tag{3}$$

Firm heterogeneity.

We assume that firms' marginal costs are drawn from a Pareto distribution. This assumption is made because, beyond tractability, it ensures that aggregate profits in each market are constant, and thus independent of the number of operating firms. It allows to focus on the case where the motive for implementing an NTM exclusively comes from a profit shifting effect between firms, i.e. a beggar-thy-neighbor motive. Specifically, we assume that marginal costs a are comprised between 0 and 1, and are drawn from a Pareto distribution $G(a)$ with a shape parameter $\rho > 1$: $G(a) = a^\rho$.[17] Finally, as we assume away free entry, we simply consider as in Chaney (2008) that there is a group of entrepreneurs proportional to country size.

Policy instrument: Non-discriminatory NTMs.

We focus on a situation where governments have to fully comply with non-discriminatory obligations. Hence, the only policy instruments available are those that affect domestic and foreign firms in the exact same way. We assume that NTMs increase fixed costs specific to the local market.[18] This assumption is widely supported by empirical evidence. SPS and TBT measures have been shown to reduce the extensive margin of trade, while the average effect on the intensive margin is basically absent (Fontagné et al. (2015), Fernandes et al. (2019)). Moreover, the impact on the intensive margin is heterogeneous. The largest exporters tend to benefit from these measures while less efficient exporters suffer (Fontagné and Orefice (2018), Fugazza et al. (2018)). These largest exporters also tend to increase their markups in reaction

the fixed production cost F_P to serve the export market only. Note also that as marginal costs are constant, no firm would choose to either produce for both markets or exit.

[17] We assume that the standard regularity condition is satisfied: $\rho - (\sigma - 1) > 0$.

[18] Note that we could also allow NTMs to affect the variable cost of all operating firms (i.e. a consumption tax). However, in this setup of monopolistic competition with CES preferences, a change in the variable cost of all firms is fully neutral. It increases all prices proportionally, and thus has the same effect on the price index. Relative prices, market shares and thus profits stay constant. Hence, the equilibrium mass of operating firms remains unaffected.

to the introduction of NTMs (Asprilla et al. (2019), Macedoni and Weinberger (2022)). This strongly suggest that NTMs mostly affect fixed costs (rather than variable costs) and generate a market share reallocation towards the most efficient firms.[19]

To ensure the cost is strictly the same, we assume that NTMs in country j increase fixed costs (F_d or F_x) by the same amount T_j, implying two opposite effects on firms profits.[20] First, it reduces profits of all operating firms, forcing the least efficient firms to exit the market. In turn, it redistributes market shares of exiters towards the firms that survive. For some of those firms, this last effect dominates and they thus benefit from this measure. Introducing the additional fixed cost T_j into (2) and (3) for a firm i and taking the derivative, we get:

$$\frac{\partial \pi_{ij}}{\partial T_j} = \underbrace{\frac{\mu}{\sigma}\frac{\partial P_j^{\sigma-1}}{\partial T_j}}_{\text{positive effect}} p_{ij}^{1-\sigma} - \underbrace{1}_{\text{negative effect}} \tag{4}$$

This highlights what we mean by non-discriminatory at the micro level: all operating firms pay the additional cost T_j, and two firms with the same local price experience the same profit variation, no matter their country of origin. We show in the next section how this simple mechanism can generate protectionism at the macro level. In the following it will be useful to measure everything relative to the fixed costs F domestic firms have to pay. Hence, we rewrite the policy instrument in country j as $T_j = \beta_j F$. Similarly, we rewrite the fixed costs foreign firms have to pay as $F_x = \gamma F$, where γ measures the relative fixed costs to access market j for domestic and foreign producers. In the following, we thus focus on the role of β_j, the policy instrument governments choose. We interpret a larger β_j as a more stringent standard or regulation (NTM) in country j.[21]

2.2 Market equilibrium

We first describe the equilibrium given the policy choices β_H and β_F. In the next section, we will analyze the government choice.

Given the symmetry of the model, we focus on the Home market. Firms first draw their marginal costs from $G(a)$. Given their draw, they decide to produce or not and whether to serve the foreign market as well. Firms decide to produce and serve the domestic market if their draw is such that $a_i \leq a_{HH}$, where a_{HH} is defined by the zero-cutoff-profit (ZCP)

[19] There is also some empirical evidence for these effects in the "raising rivals' costs" literature. One example is Suzuki (2013) who shows that an increase of one standard deviation in land use regulation in Texas increases the entry cost in the lodging industry by 10%, decreases the number of operating firms (hotels) by 15% and increases the revenue per room by 6%.

[20] We show in appendix B1 that the cost of NTMs could be increasing in firm size without affecting our results.

[21] In the following, we may also refer to a larger β_j as a higher level of NTMs, or to an increase in NTMs.

condition $\pi_{HH}(a_{HH}) = 0$. Foreign firms decide to serve the Home market if their draw is such that $a_i \leq a_{FH}$, where a_{FH} is defined by the ZCP $\pi_{FH}(a_{FH}) = 0$. Using these two conditions and the price index definition, it is straightforward to solve for the two endogenous variables a_{HH} and a_{FH}. The mass of Home and Foreign firms serving the Home market are:[22]

$$a_{HH}^{\rho} = \frac{\mu}{\sigma\lambda F}\frac{1}{(1+\beta_H)}\frac{1}{1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}} \tag{5}$$

$$a_{FH}^{\rho} = \frac{\mu}{\sigma\lambda F}\frac{1}{(1+\beta_H)}\frac{\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}}}{1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}} \tag{6}$$

with $\lambda = \frac{\rho}{1-\sigma+\rho}$. This allows to compute the aggregate profits made by Home firms in market H: $\Pi_{HH} = \int_0^{a_{HH}} \pi_{HH}(a)dG(a)$ and the aggregate profits made by Foreign firms in market H: $\Pi_{FH} = \int_0^{a_{FH}} \pi_{FH}(a)dG(a)$. We get:

$$\Pi_{HH}(\beta_H) = \frac{\mu}{\rho}\left(\frac{\sigma-1}{\sigma}\right)\frac{1}{1+\tau^{1-\sigma}\left(\frac{(1+\beta_H)}{(\gamma+\beta_H)}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}} \tag{7}$$

$$\Pi_{FH}(\beta_H) = \frac{\mu}{\rho}\left(\frac{\sigma-1}{\sigma}\right)\frac{\frac{\gamma+\beta_H}{1+\beta_H}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}}}{1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}} \tag{8}$$

Here appears an important property of the Pareto distribution: the aggregate profits made by operating firms is independent of the stringency of the NTM β_H:

$$\Pi_{HH} + \Pi_{FH} = \frac{\mu}{\rho}\left(\frac{\sigma-1}{\sigma}\right) \tag{9}$$

This implies that the total fixed cost paid by all operating firms in the local market is independent of β_H: an increase in β_H forces some domestic and foreign firms to exit, reducing the total fixed cost paid. This reduction is exactly offset by the increase the in fixed cost paid by survivors when the distribution is Pareto. It follows:

Lemma 1. *The profit variation of any set of firms due to any NTM is equal to the opposite of profit variation of all other firms.*

A change in the stringency of the NTM thus only affects the sharing of the total profits in

[22] We assume that $\frac{\mu}{\sigma\lambda F} < 1$, to ensure there is always selection.

a market. We get:

$$\frac{\partial \Pi_{HH}}{\partial \beta_H} = (1-\gamma)\frac{\mu}{\sigma\lambda}\frac{\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}}}{(1+\beta_H)^2\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}\right)^2} \tag{10}$$

While non-discriminatory, the NTM produces an aggregate profit shifting between domestic and foreign firms, as long as $\gamma \neq 1$: there is not only a profit shifting from less to more efficient firms, the sharing of the aggregate profits between Home and Foreign firms is also affected, i.e. there is a macro distortion. What is driving this result? The NTM firms have to pay to serve the domestic market is the same for domestic and foreign firms. However, the NTM distorts the relative fixed cost that domestic and foreign firms have to pay in order to operate in the domestic market. The percentage increase in the total fixed cost paid to operate is equal to β_H for domestic firms and to $\frac{\beta_H}{\gamma}$ for foreign firms. Therefore, as the change in demand ($\mu P^{\sigma-1}$) is the same for all firms, the group that faces a larger percentage fixed cost increase will experience a fiercer selection due to the NTM. It follows that, if $\gamma < 1$, an NTM implementation is tougher for foreign firms than for domestic firms (a_{FH} decreases relatively more than a_{HH}) and generates an aggregate profit shifting from foreign to domestic firms.[23] It follows:

Lemma 2. *If $\gamma < 1$, the profit variation of all domestic firms on the domestic market due to any NTM is positive: a non-discriminatory NTM has an aggregate protectionist effect.*

In the following, we will restrict our analysis to the case $\gamma < 1$.[24] As fixed costs determine the average firm size in this setup, this assumption implies that domestic firms are on average larger than foreign firms in the domestic market. This also implies that all exporters sell more domestically than abroad.[25] This case seems to be the most empirically relevant. For example, Eaton et al. (2011) show that the export intensity by market varies between 0.01 and 0.1 for French exporters, while this assumption only requires the export intensity by market to be lower than 0.5.[26] Hence, foreign firms exit more in this case because the same additional cost is associated for them with a smaller market size. Moreover, $\gamma < 1$ is also in line with recent calibrations of trade models with heterogeneous firms. For example, di Giovanni and Levchenko

[23]Note that if $\gamma = 1$, an increase in β_H does not affect the aggregate profits of foreign firms. The higher fixed cost is paid by fewer foreign firms, such that the total (aggregate) fixed cost paid by foreign firms stays constant. It follows that in the absence of a protectionist effect, NTMs do not generate any international inefficiency.

[24]Note that this restriction is fully compatible with $F_x > F_d$.

[25]The assumption $F < F_x\tau^{\sigma-1}$ only implies that exporters are the most efficient firms. For a given exporter however, it puts no restriction on the relative sales between the domestic and export market.

[26]In this two-country model, there is no difference between the overall export intensity and the export intensity by market. In a multi-country version of the model, this assumption only requires that the main market (in terms of sales) is the domestic market. It thus does not restrict the overall export intensity to be less than 50%.

(2012) have calibrated a model in line with our framework and find that, over a sample of 50 countries, fixed costs associated with entry in a foreign market are on average about 40% of the fixed costs associated with domestic production, i.e. $\gamma = 0.4$. Melitz and Redding (2015) also calibrate a heterogeneous firm trade model and pick $\gamma = 0.545$ in order to match the average fraction of U.S. manufacturing firms that export.

Finally, welfare in the Home country $W_H(\beta_H, \beta_F)$ is defined as:

$$W_H(\beta_H, \beta_F) = \Pi_H(\beta_H, \beta_F) + 1 + S_H(\beta_H) \tag{11}$$

Indirect utility is the sum of total income, i.e. firms' profits in both markets: $\Pi_H(\beta_H, \beta_F) = \Pi_{HH}(\beta_H) + \Pi_{HF}(\beta_F)$, labor earnings (normalized to 1), and consumer surplus $S_H(\beta_H) = \mu \ln \frac{\mu}{P_H} - \mu$. As shown in appendix D, while the profit shifting effect generates some income gain for Home, it is not sufficient to increase consumer welfare, the negative effect on consumer surplus due to the loss of varieties being too strong.

NTMs are usually assumed to generate positive welfare effects, justifying their implementation despite the additional costs they imply. We could for example assume here that NTMs reduce an "eye-sore" negative consumption externality that is not internalized by individual consumers, leaving the model unchanged.[27] Yet, we will follow another approach here, as the mechanism emphasizes a major role for producers' interests. We will assume that the government has some distributional concerns and put too much weight on firms profits compared to the social planner. This allows to focus on the profit shifting as the unique motive behind an NTM. Moreover, this enables to look at a possible bias of the government towards some firms and its consequences for the outcome of a deep trade agreement.

2.3 Discussion

Before turning to the equilibrium policy choice, we first discuss the robustness of the mechanism and the role of the main assumptions of the model. We summarize the main conclusions here and refer the reader to the appendix for details.

The model assumes a fixed number of firms. This leads to positive profits in equilibrium making natural the introduction of political economy motives. The alternative is to introduce a free entry condition. Entrants would thus drive expected profits to zero. In the appendix, we develop two cases of the model with free entry. In appendix A1, we introduce a free entry condition in the model above, where, due to the presence of the outside sector, labor supply is

[27] For example, this assumption is made in Staiger and Sykes (2011, 2021) and Mei (2021). We develop this case in appendix D and show that governments choose too stringent NTMs compared to the first best because of their protectionist effect.

fully elastic. In this case, an NTM still distorts relative costs as before, and make the Home market relatively more attractive for Home firms. The mass of entrants thus increases at Home and decreases in Foreign. a_{HH} decreases while a_{FF} increases due to a weakened competition in the Foreign market. This also leads a_{HF} to increase. Together with a larger entry rate at Home, this implies that Home firms not only gain market shares in the Home market, but also in the Foreign market. However as above, less varieties are available to consumers, implying that this policy would not be welfare improving in the absence of the reduction of a negative externality. Note that if $\gamma = 1$, an NTM does not distort relative costs, the mass of entrants is thus left unaffected in both countries and there is no gain of the NTM for Home beyond its impact on a negative externality. In appendix A2, we consider instead a one sector version of the model with free entry, where labor supply is thus inelastic. This case is interesting because the initial equilibrium is optimal from a planner perspective. It thus shows that the incentive to implement an NTM is not driven by the monopolistic distortion present in the two sector model. Moreover, as wages adjust in this version of the model, it allows a terms of trade interpretation of the motive behind an NTM. In this case, the mechanism works in the exact same way. The NTM makes the Home market relatively more profitable for Home firms. This increases labor demand at Home and reduces labor demand in Foreign, generating a rise in relative wages, i.e. an improvement in Home's terms of trade. Again, all these effects disappear for $\gamma = 1$.

The mechanism put forward in this paper can thus be interpreted in different ways, depending on the modelling choices. The free entry condition can be seen as a more long run view of the model. Hence, an NTM would first increase profits of domestic firms. Over time, this effect would be diluted into firm entry and higher wages. Yet, the distortive effect favoring Home firms remains. Second, in all cases the only source of international inefficiency is the macro distortion: when $\gamma = 1$, an NTM does not create any international inefficiency (Foreign welfare is unaffected). NTMs reallocate profits between Foreign firms but at the macro level, the Foreign industry does not suffer in that case, which is the result of the selection into exporting and the use of the Pareto distribution.[28] This highlights that the use of NTMs, beyond their possible protectionist effects, does not necessarily imply a global inefficiency.

The model assumes that NTMs induce the same additional fixed cost for all firms. This is motivated by the empirical evidence strongly suggesting that NTMs affect fixed costs, and the need to have a policy instrument that is fully non-discriminatory. Fixed costs may however be size dependent. Hence, in appendix B1, we allow fixed costs and NTMs to increase with firm

[28]The Pareto distribution ensures that aggregate profits are constant. Selection into exporting implies that firms in the foreign country that do not export are not affected by NTMs at Home.

size and show that our results are left unchanged. Another alternative is that NTMs affect fixed costs paid by firms in a proportional way.[29] In our setup with a Pareto distribution, this would not generate any profit shifting effect. In appendix B2, we thus remove the assumption of $G(a)$ being Pareto to analyze this case, showing how it can also induce a profit shifting effect. With a Pareto distribution, the hazard rate is constant along the distribution. Therefore, the relative exit rate depends only on the cutoffs ratio $\frac{a_{FH}}{a_{HH}}$ and not on where the cutoffs are. A proportional fixed cost increase leaves this ratio unaffected. Away from Pareto however, even if $\frac{a_{FH}}{a_{HH}}$ is constant, the mass of firms that exit may differ between Home and Foreign firms. Hence, if the hazard rate is larger around a_{FH} than around a_{HH}, NTMs increase the aggregate market share of Home firms, inducing a protectionist effect.[30]

NTMs could additionally affect variable costs, even though it does not seem to be a first order feature in the data. With CES preferences, this does not affect the equilibrium as relative prices do not change, nor the ratio of the two cutoffs. Away from CES however, mark-ups are no more constant along the distribution. This has three consequences. First, a variable cost increase has a different impact on prices around the two cutoffs if the price elasticity is not the same, leading to a different exit rate between domestic and foreign firms. Second, as relative prices are distorted, it also reallocates market shares among incumbents. The direction of this reallocation depends on the relative love for variety in the utility function (see Zhelobodko et al. (2012)). Third, this reallocation across firms of different productivity may improve or worsens the allocative efficiency (see Dhingra and Morrow (2019)).[31] This introduces important new concerns into the government's decision other than protectionism and thus fall outside the scope of this paper. In the following, we restrict our analysis to the case of an equal additional fixed cost for all. Yet, in more general environments, NTMs can take other forms and still generate protection at the macro level (on top of other effects).

[29] In this case, the fixed cost paid by Home firms would increase by an amount $\beta_H F$ and the one paid by Foreign firms by $\beta_H \gamma F$. Note that this might potentially raise the question of discrimination, as it would imply a fixed cost increase that would be different between domestic and foreign firms.

[30] Note also that away from Pareto, aggregate profits are no more constant, because the aggregate fixed cost increase paid by surviving firms does not equalize aggregate fixed costs saved due to the exit of the least efficient firms. Therefore, aggregate profits of Home and Foreign firms may both increase or decrease, depending on the relative strength of these two effects and NTMs may have other motives than protectionism only.

[31] See also Macedoni and Weinberger (2022) for a recent contribution considering the effect of standards on the allocative efficiency.

3 Equilibrium policy choice

3.1 Government objective function

We assume that the objective function of the government is a weighted average between social welfare and profits of domestic firms. The political economy motives behind this objective function may be easily micro-funded via the Protection for Sale framework of Grossman and Helpman (1994), assuming that the entire domestic industry is politically organized.[32] We may alternatively assume that the government only cares about the profits of a subset of firms only (those that would be organized). We assume that the government objective function takes the following form:

$$G_H(\beta_H, \beta_F) = \alpha W_H(\beta_H, \beta_F) + (1-\alpha)\,\Pi_H\,(\beta_H, \beta_F) \tag{12}$$

with $\alpha \in (0,1)$. In this setup without income effects, NTMs have only local effects. Variations in total income only translate into variations in the consumption of the numeraire good. Hence, NTMs at Home do not affect spending and thus profits in the Foreign market. Similarly, consumer surplus only depends on the decision made by the domestic government and is not affected by the foreign government's decision. The optimal choice for the government is given by:

$$\alpha \frac{\partial W_H(\beta_H, \beta_F)}{\partial \beta_H} + (1-\alpha)\,\frac{\partial \Pi_H(\beta_H, \beta_F)}{\partial \beta_H} = 0 \tag{13}$$

This greatly simplifies the analysis. Given that profits are separable and immune from the policy choice in the other market, the decision of the two governments are independent. No matter the decision of the Foreign government, the decision of the Home government only affects the sharing of aggregate profits in the Home market. In other words, the reaction functions of the two governments are orthogonal. The optimal choice of the government is thus given by:

$$\alpha \frac{\partial S_H(\beta_H)}{\partial \beta_H} + \frac{\partial \Pi_{HH}(\beta_H)}{\partial \beta_H} = 0 \tag{14}$$

The implementation of NTMs has two effects. First, it reduces consumer surplus, by forcing some firms to exit the market: $\frac{\partial S_H(\beta_H)}{\partial \beta_H} < 0$. Second, as shown above, it increases the aggregate market share of Home firms in their domestic market, thus increasing their profits: $\frac{\partial \Pi_{HH}}{\partial \beta_H} > 0$. As NTMs only generate a local externality, the government decision boils down to a trade-off between the (weighted) loss of consumer surplus and the income gain coming from the profit shifting.

[32] Note that this formulation may also capture other political economy motives for protection since in this setup firm profits are proportional to firm sales and to employment in the manufacturing sector.

3.2 Non-cooperative equilibrium policy choice

Replacing into (14) and rearranging, we obtain an implicit solution for β_H^{NC}, the solution of the non-cooperative equilibrium:

$$\frac{\sigma-1}{\sigma} = \alpha\frac{1+\beta_H^{NC}}{1-\gamma}\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H^{NC}}{\gamma+\beta_H^{NC}}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}-1}\right)\left(1+\left(\frac{\gamma+\beta_H^{NC}}{1+\beta_H^{NC}}\tau^{\sigma-1}\right)^{\frac{\rho}{\sigma-1}}\right) \quad (15)$$

The right-hand side of this expression is monotonically increasing. This ensures a unique solution β_H^{NC}, if α is low enough.[33] The more the government puts weight on domestic profits and income (lower α), the larger β_H^{NC}. With an NTM, the government pushes the economy to produce and consume a smaller mass of varieties. Even if this effect is opposite to closing the gap with the social planner solution, it allows the domestic industry to capture more of the rents in the monopolistic sector. In other words, governments may run non-discrimnatory protectionist policies with cost increasing instruments, *despite* the fact that these policies bring the economy further away from the first best.

We have assumed here that the government cares about the entire domestic industry. From a lobbying perspective however, if only the most efficient firms are organized as suggested in the literature (e.g. Bombardini (2008), Blanga-Gubbay et al. (2020)), the outcome may be a more stringent NTM, because the most efficient firms are those that gain from the profit shifting. This will be crucial when looking at the outcome of the cooperative equilibrium.

Trade openness.

One important question is the impact of trade openness on the equilibrium level of NTMs. Two possibilities have been put forward. During the multilateral negotiations leading to the creation of the WTO, a serious concern in the public debate was the possibility of a race to the bottom with respect to domestic regulations due to the fiercer market competition induced by lower tariffs (see Bagwell and Staiger (2001) for a discussion). The literature has alternatively suggested that there could be some trade policy substitution. As countries commit to reduce tariffs, they may be tempted to use other policy instruments to restore previous levels of trade protection (see Kee et al. (2009), Limao and Tovar (2011), Beverelli et al. (2019)). The empirical evidence points to an increase in NTMs over time (e.g. Ederington and Ruta (2016)). This paper proposes another reason for this trend. Trade liberalization may increase the equilibrium level of NTMs because the induced profit shifting effect is larger with lower trade costs. We get:

[33] See appendix D for a proof.

Proposition 1. *The lower the variable trade costs, the larger* β_H^{NC}.

Proof. see appendix D.

This result may sound like a trade policy substitution. It is however driven by the increased efficiency of NTMs at shifting profits when trade costs are low. When trade is more open, Foreign firms benefit from a better access to the Home market and thus a larger local aggregate profit share. A given NTM still forces the least efficient firms to exit, but the exit differential between Home and Foreign firms is magnified with lower trade costs, as can be easily checked taking the ratio of (5) and (6). In turn, the same NTM leads to a larger aggregate profit shifting with lower trade costs, i.e. $\frac{\partial^2 \Pi_{HH}(\beta_H)}{\partial \beta \partial \tau} < 0$. The efficiency of NTMs to protect the domestic industry is thus increased by lower trade costs.[34] This result echoes the one in Campolmi et al. (2022). When trade costs are low and economies more integrated, instruments that have protectionist effects become more effective (while in autarky they would be useless). It follows that with low trade costs, it becomes more important to find a cooperative solution over domestic regulations and standards.

From the perspective of a lobbying model where the domestic industry is organized, this result is also interesting. A decrease in trade costs increases market competition which in turn decreases market shares of all domestic firms. In contrast to the race to the bottom hypothesis, the optimal response of an organized sector in that case is not to ask for *less* taxation, but for *more*. This result may be a reason why trade liberalization seems to have increased incentives to implement these NTMs. At least part of this increase may be due to the improved protectionist effect of these measures, even if they are fully non-discriminatory.

3.3 Cooperative equilibrium

Cooperative equilibrium policy choice and reciprocity.

When countries implement NTMs, the non-cooperative equilibrium is inefficient and countries are trapped in a prisoner dilemma. The aggregate profit gain in the domestic market is eliminated by the aggregate profit loss in the export market, while consumer surplus decreases due to less varieties available. A trade agreement can however solve the problem. Under cooperation, governments decide on β_H and β_F to generate a Pareto improving solution that maximize

[34] In appendix D, we show that β_H^{NC} is also larger when γ and σ are smaller. The relative cost increase induced by NTMs is larger when γ is small, which in turn forces relatively more foreign firms to exit, all else equal. NTMs are also more effective when σ is small (i.e. varieties are less substitutable) because, all else equal, firms that exit were larger and making more profits.

their joint objective function $G^W(\beta_H, \beta_F)$. We have:

$$\begin{aligned} G_H(\beta_H, \beta_F) &= \alpha + \alpha S_H(\beta_H) + \Pi_H(\beta_H, \beta_F) \\ G_F(\beta_F, \beta_H) &= \alpha + \alpha S_F(\beta_F) + \Pi_F(\beta_F, \beta_H) \end{aligned}$$

Recall that $\Pi_H(\beta_H, \beta_F) + \Pi_F(\beta_F, \beta_H) = 2\frac{\mu}{\rho}\left(\frac{\sigma-1}{\sigma}\right)$. It follows:

$$G^W(\beta_H, \beta_F) \equiv G^H(\beta_H, \beta_F) + G^F(\beta_F, \beta_H) = 2\frac{\mu}{\rho}\left(\frac{\sigma-1}{\sigma}\right) + \alpha\left(2 + S_H(\beta_H) + S_F(\beta_F)\right) \quad (16)$$

The solution of the cooperative equilibrium, defined by $\beta_H^{CE} = \beta_F^{CE} = 0$, is the first best. Indeed, NTMs shift profits between countries but income is constant at the world level, no matter the level of NTMs (see (9)). Besides, they only generate additional costs without any positive welfare effect. The inefficiency of the non-cooperative equilibrium only comes from these NTMs, motivated by a profit shifting externality.

The principle of reciprocity is defined in a broad way in the WTO texts, stating that countries should exchange "equivalent concessions" in trade barriers reductions. Depending on the international inefficiency a trade agreement has to solve, reciprocity has been formalized in different ways.[35] In this model, the inefficiency is coming from the profit shifting externality only. Reciprocity should thus require that a trade agreement keeps the profit balance constant between countries, thus eliminating this externality. More precisely, define the aggregate profit variation between the cooperative and the non-cooperative equilibrium in each country as $\Delta\Pi_H(\beta_H, \beta_F) = \Pi_H\left(\beta_H^{CE}, \beta_F^{CE}\right) - \Pi_H\left(\beta_H^{NC}, \beta_F^{NC}\right)$ and $\Delta\Pi_F(\beta_F, \beta_H) = \Pi_F\left(\beta_F^{CE}, \beta_H^{CE}\right) - \Pi_H\left(\beta_F^{NC}, \beta_H^{NC}\right)$. We define reciprocity as:

$$\Delta\Pi_H(\beta_H, \beta_F) - \Delta\Pi_F(\beta_H, \beta_F) = 0 \quad (17)$$

In this symmetric setup, a trade agreement based on the principle of reciprocity can restore efficiency; the two countries can make "equivalent concessions" by each withdrawing their NTMs. This withdrawal implies that each country increases its imports from the other country, reducing profits in the domestic market that are compensated in the export market. There is thus an equal exchange of aggregate profits while consumer surplus is increased in both countries.

[35] In a perfectly competitive setting, Bagwell and Staiger (1999) (see also Bagwell and Staiger (2001) for the case of domestic policies) define it as an equivalent exchange of market access between countries, thus ensuring no terms of trade manipulation. In a model with a delocation motive for trade policy, Ossa (2011) formalizes it as an increase in imports, keeping the trade balance unchanged, therefore eliminating the possibility of delocation in his setup. Mrazova (2021) shows that in an oligopolistic setup, reciprocity implies keeping the profit balance between countries constant. The same definition is used here.

Cooperative equilibrium and set of organized firms.

However, whether a trade agreement that respects reciprocity allows to reach the first best depends critically on the set of firms included in the objective function of governments. Suppose now that in each country, only the most efficient exporters are organized and influence the government decision. Therefore the Home government, instead of taking into account the profits of the entire domestic industry $\Pi_H(\beta_H, \beta_F)$, only cares about the profits of these firms: $\widetilde{\Pi_H}(\beta_H, \beta_F) = \widetilde{\Pi_{HH}}(\beta_H) + \widetilde{\Pi_{HF}}(\beta_F)$. The aggregate protectionist effect derived before implied $\frac{\partial \Pi_{HF}(\beta_F)}{\partial \beta_F} < 0$ (see (10)). However, if only the most efficient exporters are considered, we now have $\frac{\partial \widetilde{\Pi_{HF}}(\beta_F)}{\partial \beta_F} > 0$; the most efficient Home exporters gain from an NTM implementation in the Foreign country. Put differently, their interest with respect to β_F is opposite to the one of the Home industry as a whole and is now aligned with organized firms in the Foreign country: lobbies have now aligned interests internationally. The joint objective function of governments can then be written as:

$$G^W(\beta_H, \beta_F) = \widetilde{\Pi_H}(\beta_H, \beta_F) + \widetilde{\Pi_F}(\beta_F, \beta_H) + \alpha\left(2 + S_H(\beta_H) + S_F(\beta_F)\right) \tag{18}$$

The joint objective of governments under cooperation does not coincide with the first best anymore as aggregate profits of organized firms worldwide increase with positive NTMs. This has an important implication for the outcome of the cooperative equilibrium. To make this point clear, suppose that in the non-cooperative equilibrium, some NTMs $\beta_H^{NC} > 0$ and $\beta_F^{NC} > 0$ are implemented. Governments then jointly negotiate β_H^{CE} and β_F^{CE}. In this case, the level of NTMs increases in both countries, because each government now internalizes that its NTMs also generate a positive externality for the best exporters (the organized firms) of the other country. We get:

$$\left.\frac{\partial G^W(\beta_H, \beta_F)}{\partial \beta_H}\right|_{\beta_H = \beta_H^{NC}} = \underbrace{\left.\frac{\partial \widetilde{\Pi_{HH}}(\beta_H)}{\partial \beta_H}\right|_{\beta_H = \beta_H^{NC}} + \alpha \left.\frac{\partial S_H(\beta_H)}{\partial \beta_H}\right|_{\beta_H = \beta_H^{NC}}}_{=0} + \left.\frac{\partial \widetilde{\Pi_{FH}}(\beta_H)}{\partial \beta_H}\right|_{\beta_H = \beta_H^{NC}} > 0$$

$$\left.\frac{\partial G^W(\beta_H, \beta_F)}{\partial \beta_F}\right|_{\beta_F = \beta_F^{NC}} = \underbrace{\left.\frac{\partial \widetilde{\Pi_{FF}}(\beta_F)}{\partial \beta_F}\right|_{\beta_F = \beta_F^{NC}} + \alpha \left.\frac{\partial S_F(\beta_F)}{\partial \beta_F}\right|_{\beta_F = \beta_F^{NC}}}_{=0} + \left.\frac{\partial \widetilde{\Pi_{HF}}(\beta_F)}{\partial \beta_F}\right|_{\beta_F = \beta_F^{NC}} > 0$$

It follows:

Proposition 2. *If only the most efficient firms are organized, a trade agreement makes both countries worse off (from a pure welfare perspective) compared to the non-cooperative equilibrium.*

This result directly relates to Rodrik (2018) and Maggi and Ossa (2020). Rodrik (2018) raises concerns about trade agreements on regulatory rules, as governments may be influenced by large exporters to shape trade agreements to capture rents in their export markets. Such agreements could be detrimental to welfare. This is precisely what is happening here. Both governments jointly agree to make NTMs more stringent to raise profits of their best exporters, at the expense of social welfare. Maggi and Ossa (2020) explore how trade agreements on domestic regulations affect welfare when governments are influenced by producer lobbies. They show that trade agreements are welfare improving if they imply internationally opposite interests among lobbies, but they can be welfare decreasing when lobbies have aligned interests internationally. In their perfectly competitive setting, they show that producer lobbies have opposite interests internationally over process standards, but aligned interests over product standards. This paper extends their result in an imperfect competition setting, however with a condition. With product standards (the case analyzed here), lobbies' interests may or may not be aligned internationally. This depends on the identity of the firms that are organized. The profit shifting we put forward in this paper implies that the most efficient firms have aligned interests worldwide. If they are the only ones organized, trade agreements may bring the economy further away from the first best.

4 Asymmetric countries and reciprocity

A deep trade agreement between two symmetric countries, based on reciprocity, can restore efficiency if governments do care about their entire domestic industry (something we assume again from now on). As we show below, this result may not hold anymore when the firm distribution is asymmetric between countries.

The problem may arise when the asymmetry in the firm distribution implies opposite incentives for governments with respect to NTMs. Intuitively, if one country has a higher aggregate productivity, even in the absence of the relative cost distortion effect (i.e. assume $\gamma = 1$), this country may implement an NTM to locally shift profits towards its domestic firms, simply because they are more productive on average. The key is that this aggregate productivity advantage may persist in the foreign market, leading this country to also benefit from an NTM abroad. If this is the case, there is no way to retaliate with another non-discriminatory NTM for the low productivity country, as this would unambiguously worsen its situation. We show in this section that a trade agreement is still possible in that case, but to be Pareto improving, it should *not* respect the principle of reciprocity.

4.1 Asymmetric firm distribution and profit shifting

To illustrate this possibility, we present here a simplified version of the model above that generates this situation while keeping the model tractable.

First, we restrict our analysis to the situation where $\gamma = 1$. We therefore abstract from the possibility that NTMs distort relative costs between Home and Foreign firms. Second, we assume no variable trade costs , i.e. $\tau = 1$. This ensures that the productivity advantage of one country carries over the other market and is not eliminated by the cost wedge implied by trade costs. It follows that two firms with the same marginal cost will serve the same markets, irrespective of their country of origin, and that their prices will be the same in each market. Therefore, the market equilibrium does not depend anymore on the origin of firms (Home or Foreign). With these restrictions, we can easily introduce any asymmetry in the firm efficiency distribution between home and foreign. We keep the Pareto distribution at the world level as before but we separate firms into Home and Foreign in a flexible way. We assume that the distribution of marginal cost at Home is given by $dG_H(a) = s(a)dG(a)$ and in Foreign by $dG_F(a) = (1 - s(a))\, dG(a)$, where $s(.)$ describes the share of firms in the world located at Home as a function of their marginal cost. We keep $s(.)$ unspecified. The model is otherwise as before.

These assumptions imply that the distribution of operating firms (both Home and Foreign) in each market is still Pareto, even if G_H and G_F are not. This guarantees that aggregate profits are constant and thus, that NTMs are still motivated by beggar-thy-neighbor reasons only. From (5) and (6) we get $a_{HH} = a_{FH}$ (and symmetrically $a_{FF} = a_{HF}$), i.e. there is only one cutoff in each market. We thus refer to the cutoff in market j as a_j, with $a_j^\rho = \frac{\mu}{2\sigma\lambda F}\frac{1}{(1+\beta_j)}$, with $j = H, F$. Given that all firms with the same productivity will serve the same markets, the average productivity of all operating firms in market j (including both Home and Foreign firms) is given by:

$$\widetilde{a_j^{1-\sigma}} \equiv \frac{\int_0^{a_j} a^{1-\sigma} dG(a)}{\int_0^{a_j} dG(a)} = \lambda a_j^{1-\sigma} \quad \text{for } j = H, F \tag{19}$$

and the average productivity of Home firms and Foreign firms in market j are given by:

$$\widetilde{a_{Hj}^{1-\sigma}} = \frac{\int_0^{a_j} a^{1-\sigma} s(a) dG(a)}{\int_0^{a_j} s(a) dG(a)} \quad \widetilde{a_{Fj}^{1-\sigma}} = \frac{\int_0^{a_j} a^{1-\sigma} (1-s(a)) dG(a)}{\int_0^{a_j} (1-s(a)) dG(a)} \tag{20}$$

To foster intuition, we take the Home perspective and assume that Home is the high productivity country, i.e. $\widetilde{a_{Hj}^{1-\sigma}} > \widetilde{a_j^{1-\sigma}} > \widetilde{a_{Fj}^{1-\sigma}}$.[36] The impact of an NTM in market j on aggre-

[36]Note that if $s(.)$ is a constant, the distribution of both Home and Foreign firms is still Pareto, just replicating

gate profits made by Home firms is given by: $\frac{\partial \Pi_{Hj}(\beta_j)}{\partial \beta_j} = \int_0^{a_j} \frac{\partial \pi_{Hj}(a,\beta_j)}{\partial \beta_j} s(a) dG(a)$.[37] The ZCP $\pi_{Hj}(a_j) = 0$ implies that $\frac{\partial \pi_{Hj}(a)}{\partial \beta_j} = F\left(\frac{a^{1-\sigma}}{\widetilde{a_j^{1-\sigma}}} - 1\right)$. A Home firm in market j thus benefits from an NTM implementation if its productivity is above the average productivity of all firms operating in this market. Note that this expression does not depend on firm location and thus also holds for a foreign firm. It follows:

$$\frac{\partial \Pi_{Hj}(\beta_j)}{\partial \beta_j} = \frac{F}{G_H(a_{Hj})}\left(\frac{\widetilde{a_{Hj}^{1-\sigma}}}{\widetilde{a_j^{1-\sigma}}} - 1\right) \tag{21}$$

As Home firms are more productive on average than Foreign firms, i.e. $\frac{\widetilde{a_{Hj}^{1-\sigma}}}{\widetilde{a_j^{1-\sigma}}} > 1$, we get $\frac{\partial \Pi_{Hj}(\beta_j)}{\partial \beta_j} > 0$ and the profit shifting favors the Home industry, in both markets. Since aggregate profits are constant, it also implies that the foreign industry loses from an NTM in each market. It follows:

Proposition 3. *A non-discriminatory NTM shifts aggregate profits in both markets towards the industry of the high productivity country: it has an aggregate protectionist effect in one country and an "anti-protectionist" in the other.*

In this situation, only Home has an incentive to put an NTM: the asymmetry in the firm distribution induces asymmetric incentives with respect to NTMs for the two governments.[38]

Note that this directly raises the question of the benefits of implementing international standards, as promoted by the TBT and SPS agreements. Suppose that NTMs have a positive effect on welfare. The implementation of an international standard will have, on top of its positive welfare effect, a redistributive effect between countries as it will induce a profit shifting effect towards firms of the same origin in the aggregate everywhere it is put in place. This echoes the complaints of developing countries about recent trade negotiations over norms and standards in the Doha round. This result also relates to Grossman et al. (2021) and Parenti and Vannoorenberghe (2021), who show that international standards may be desirable only among similar countries. In these papers, similarity is with respect to the demand side, while we focus

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the world distribution: $\widetilde{a_{Hj}^{1-\sigma}} = \widetilde{a_{Fj}^{1-\sigma}} = \widetilde{a_j^{1-\sigma}}$, i.e. there is no average productivity difference between Home and Foreign firms in each market.

[37] Note that $\frac{\partial a_j}{\partial \beta_j}\pi_{Hj}(a_j) = 0$.

[38] The non-cooperative equilibrium is defined by:

$$\frac{\partial \Pi_{jj}(\beta_j)}{\partial \beta_j} + \alpha \frac{\partial S(\beta_j)}{\partial \beta_j} = 0 \Leftrightarrow \frac{G(a_j)}{G_H(a_{jj})}\left(\frac{\widetilde{a_{jj}^{1-\sigma}}}{\widetilde{a_j^{1-\sigma}}} - 1\right) = 2\alpha \frac{\sigma}{\sigma - 1}, \text{ for } j = H, F.$$

Therefore, a government may implement an NTM only if the average productivity of its domestic firms is higher than the one of all operating firms in its domestic market, i.e. $\widetilde{a_{jj}^{1-\sigma}} > \widetilde{a_j^{1-\sigma}}$.

here on the supply side.

Before turning to the cooperative equilibrium, it may be useful to underline when this situation may arise. First, note that in this model labor supply is fully elastic, wages are thus constant. In general however, we may expect the high productivity country to also have higher wages. If wages absorb all the productivity advantage, firms would lose their competitive advantage, and while the cost distortion effect studied above would remain (see appendix A2), the effect of size put forward here would vanish. In other words, what determines the direction of the profit shifting is the firms' competitiveness in the local market. Second, this productivity advantage may also disappear in the other market due the cost wedge implied by trade costs. It follows that the issue raised here is more likely to arise when trade costs are low, i.e. is more likely after a shallow integration.

4.2 Cooperative equilibrium and reciprocity

The first best is characterized by the maximization of the joint welfare of governments, as defined in (16). The condition for a cooperative equilibrium to emerge is to be Pareto improving. We consider a situation where there is an inefficiency to solve, namely that the high productivity country has chosen to implement some NTMs in the non-cooperative equilibrium: $\beta_H^{NC} > 0$. The low productivity country is harmed by the beggar-thy-neighbor policy of the high productivity country and cannot retaliate: $\beta_F^{NC} = 0$. Again, we define the variation between the cooperative equilibrium situation and the non-cooperative one with Δ. A cooperative agreement thus needs to respect the following two conditions:

$$\Delta G_H(\beta_H, \beta_F) \equiv G^H(\beta_H^{CE}, \beta_F^{CE}) - G^H(\beta_H^{NC}, \beta_F^{NC}) \geq 0 \tag{22}$$

$$\Delta G_F(\beta_F, \beta_H) \equiv G^F(\beta_F^{CE}, \beta_H^{CE}) - G^F(\beta_F^{NC}, \beta_H^{NC}) \geq 0 \tag{23}$$

The variation in the objective functions of the two governments is the (weighted) sum of the variation of consumer surplus and the variation in aggregate profits. Note that as aggregate profits are constant, $\Delta\Pi_F(\beta_H, \beta_F) = -\Delta\Pi_H(\beta_H, \beta_F)$. We may thus rewrite these two conditions as:

$$\Delta G_H(\beta_H, \beta_F) \geq 0 \Leftrightarrow \Delta\Pi_H(\beta_H, \beta_F) + \alpha\Delta S_H(\beta_H) \geq 0 \tag{24}$$

$$\Delta G_F(\beta_F, \beta_H) \geq 0 \Leftrightarrow \alpha\Delta S_F(\beta_F) - \Delta\Pi_H(\beta_H, \beta_F) \geq 0 \tag{25}$$

To be Pareto improving, a deep trade agreement needs to respect the following necessary

condition:

$$\Delta\Pi_H(\beta_H, \beta_F) \leq 0 \tag{26}$$

It follows:

Proposition 4. *When countries have opposite incentives with respect to NTMs in the non-cooperative equilibrium, a Pareto improving agreement requires an international income redistribution from the high to the low productivity country.*

Proof. see appendix E.

A Pareto improving trade agreement implies an aggregate profit shifting from country H to country F ($\Delta\Pi_H(\beta_H, \beta_F) \leq 0$) and thus an international income redistribution, in contradiction to reciprocity. This is intuitive: to improve world welfare, the Home government should decrease its NTMs (which is the only inefficiency), therefore allowing more for Foreign firms to access its market. This implies a cost for Home that needs to be compensated by an increase in the NTMs in the Foreign country, in turn implying more market access and more profits for Home firms there. As a result, both countries increase their imports. However, this increase in NTMs reduces social welfare in the Foreign country, while the reduction of the NTMs improves social welfare at Home. Put differently, these new NTMs levels, chosen to grant more local profits to the other country, have asymmetric welfare effects. Therefore, to get a Pareto improving agreement, countries should not keep the profit balance constant as required by the principle of reciprocity. They should accept an international income redistribution from Home to Foreign.

We have considered a model with only one monopolistic sector. The main argument however extends to a multi-sector case. Suppose a multi-sector version of the model with some comparative advantages. In the non-cooperative equilibrium, countries would put NTMs in sectors where they have a comparative advantage to increase the profits of their local industry. As long as both countries implement NTMs, a trade agreement based on reciprocity can improve the situation. As in the symmetric case, both countries would withdraw their NTMs, opening their market to the other country, keeping the profit balance constant. However, after this process, one country may have eliminated all its NTMs, while the other country may have not. If this happens, we are back to the logic of the asymmetric case where, to make more progress (i.e. to improve efficiency further), unequal exchange of profits is the only solution.

5 Conclusion

This paper has shown that non-discriminatory NTMs can be used as protectionist tools, by reallocating market shares towards domestic firms in the local market. This means that non-discriminatory requirements do not avoid the possibility of beggar-thy-neighbor policies. Moreover, this type of policy becomes more efficient as the economy becomes more open to international trade, providing a possible reason for the rise in NTMs observed over the years after the creation of the WTO. It also shows trade agreements may be welfare detrimental if governments are only influenced by the most efficient firms, as informally argued by Rodrik (2018). When countries differ in their firm productivity distribution, the implementation of international standards induces some international income distribution. In this context, a deep trade agreement (on domestic regulation) should not be based on reciprocity to ensure a Pareto improvement. These results may explain why recent negotiations have proven difficult.

Overall, these results question the efficiency of the two key principles of the WTO when negotiations deal with domestic policies and firms are heterogenous. WTO redactors were aware of these possible problems. The answer has been the inclusion of the non-violation clause, allowing complaints even if no agreement has been violated. However, analyzing various non-violation claims, Staiger and Sykes (2011) conclude that "the pertinent non-violation decisions to date all seem to suggest that the measure in question must somehow favor domestic over imported goods. A regulatory measure that disadvantages them equally (in non-discriminatory fashion) seems outside the scope of the doctrine". This paper thus suggests that a new doctrine is needed for international trade rules over domestic policies.

References

Anderson, J. (2013). Measurement of protection. In Bernhofen, D., Falvey, R., Greenaway, D., and Kreickemeier, U., editors, *Palgrave Handbook of International Trade*, chapter 11, pages 321–348. Palgrave Macmillan.

Asprilla, A., Berman, N., Cadot, O., and Jaud, M. (2019). Trade policy and market power: firm-level evidence. *International Economic Review*, 60(4):1647–1673.

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

Bagwell, K. and Staiger, R. W. (2001). Domestic policies, national sovereignty, and international economic institutions. *The Quarterly Journal of Economics*, 116(2):519–562.

Baldwin, R. (2000). Regulatory protectionism, developing nations and a two-tier world trade system. C.E.P.R. Discussion Papers 2574.

Beverelli, C., Boffa, M., and Keck, A. (2019). Trade policy substitution: Theory and evidence. *Review of World Economics*, 155(4):755–783.

Blanga-Gubbay, M., Conconi, P., and Parenti, M. (2020). Globalization for sale. manuscript.

Bombardini, M. (2008). Firm heterogeneity and lobby participation. *Journal of International Economics*, 75(2):329–348.

Campolmi, A., Fadinger, H., and Forlati, C. (2022). The design of trade agreements under monopolistic competition. manuscript.

Chaney, T. (2008). Distorted gravity: The intensive and extensive margins of international trade. *The American Economic Review*, 98(4):1707–1721.

Costinot, A. (2008). A comparative institutional analysis of agreements on product standards. *Journal of International Economics*, 75(1):197–213.

Dhingra, S. and Morrow, J. (2019). Monopolistic competition and optimum product diversity under firm heterogeneity. *Journal of Political Economy*, 127(1):196–232.

di Giovanni, J. and Levchenko, A. A. (2012). Country size, international trade, and aggregate fluctuations in granular economies. *Journal of Political Economy*, 120(6):1083–1132.

Eaton, J., Kortum, S., and Kramarz, F. (2011). An anatomy of international trade: Evidence from french firms. *Econometrica*, 79(5):1453–1498.

Ederington, J. and Ruta, M. (2016). Nontariff measures and the world trading system. In Bagwell, K. and Staiger, R. W., editors, *Handbook of Commercial Policy*, volume 1B, chapter 5, pages 211 – 277. Elsevier.

Fernandes, A., Ferro, E., and Wilson, J. (2019). Product standards and firms' export decisions. *World Bank Economic Review*, 33(2):353–374.

Fischer, R. and Serra, P. (2000). Standards and protection. *Journal of International Economics*, 52(2):377–400.

Fontagné, L. and Orefice, G. (2018). Let's try next door: Technical barriers to trade and multi-destination firms. *European Economic Review*, 101(C):643–663.

Fontagné, L., Orefice, G., Piermartini, R., and Rocha, N. (2015). Product standards and margins of trade: Firm-level evidence. *Journal of International Economics*, 97(1):29–44.

Fugazza, M., Olarreaga, M., and Ugarte, C. (2018). On the heterogeneous effects of market access barriers: evidence from small and large peruvian exporters. C.E.P.R. Discussion Papers 12876.

Grossman, G. M. and Helpman, E. (1994). Protection for sale. *American Economic Review*, 84(4):833–850.

Grossman, G. M., McCalman, P., and Staiger, R. W. (2021). The "new" economics of trade agreements: From trade liberalization to regulatory convergence? *Econometrica*, 89(1):215–249.

Kee, H. L., Nicita, A., and Olarreaga, M. (2009). Estimating trade restrictiveness indices. *The Economic Journal*, 119(534):172–199.

Limao, N. and Tovar, P. (2011). Policy choice: Theory and evidence from commitment via international trade agreements. *Journal of International Economics*, 85(2):186–205.

Macedoni, L. and Weinberger, A. (2022). Quality heterogeneity and misallocation: The welfare benefits of raising your standards. *Journal of International Economics*, 134:103544.

Maggi, G. and Ossa, R. (2020). Are trade agreements good for you? manuscript.

Mei, Y. (2021). Regulatory protection and the role of international cooperation. manuscript.

Melitz, M. J. and Redding, S. J. (2015). New trade models, new welfare implications. *American Economic Review*, 105(3):1105–1146.

Mrazova, M. (2021). Trade negotiations when profits matter. manuscript.

Ossa, R. (2011). A "new trade" theory of gatt/wto negotiations. *Journal of Political Economy*, 119(1):122–152.

Parenti, M. and Vannoorenberghe, G. (2021). A simple theory of deep trade intergation. manuscript.

Rodrik, D. (2018). What do trade agreements really do? *Journal of Economic Perspectives*, 32(2):73–90.

Rogerson, W. P. (1984). A note on the incentive for a monopolist to increase fixed costs as a barrier to entry. *The Quarterly Journal of Economics*, 99(2):399–402.

Salop, S. C. and Scheffman, D. T. (1983). Raising rivals' costs. *The American Economic Review*, 73(2):267–271.

Staiger, R. and Sykes, A. O. (2011). International trade, national treatment, and domestic regulation. *The Journal of Legal Studies*, 40(1):149 – 203.

Staiger, R. W. and Sykes, A. O. (2021). The Economic Structure of International Trade-in-Services Agreements. *Journal of Political Economy*, 129(4):1287–1317.

Suwa Eisenmann, A. and Verdier, T. (2002). Reciprocity and the political economy of harmonization and mutual recognition of regulatory measures. C.E.P.R. Discussion Papers 3147.

Suzuki, J. (2013). Land use regulation as a barrier to entry: evidence from the texas lodging industry. *International Economic Review*, 54(2):495–523.

Sykes, A. (1999). Regulatory protectionism and the law of international trade. *The University of Chicago Law Review*.

Zhelobodko, E., Kokovin, S., Parenti, M., and Thisse, J.-F. (2012). Monopolistic competition: Beyond the constant elasticity of substitution. *Econometrica*, 80(6):2765–2784.

Online Appendix

A Model with Free Entry.

A.1 Free entry and elastic labor supply

The model is as in the main text, except that we now introduce a free entry condition. Hence, firms first have to pay an entry sunk cost F_E in order to draw their marginal cost from the distribution $G(a)$. Firms pay F_E as long as their expected profits are larger than F_E. This has two implications. First, there are no profits in the industry in equilibrium as profits of active firms just cover the sunk costs paid by entrants. Welfare variations are thus only driven by the price index variation as income is constant (nominal wages are constant). Second, the mass of firms in each country becomes endogenous, as new profit opportunities induce some entry of new firms. We define M_H and M_F as the mass of entrants in each market (i.e. firms that pay F_E, among which only a subset will be active in equilibrium). The difference with the model in the main text is thus the introduction of the following two free entry (FE) conditions:

$$\text{in } H \quad : \quad \int_0^{a_{HH}} \pi_{HH}(a)\, dG(a) + \int_0^{a_{HF}} \pi_{HF}(a)\, dG(a) = F_E \tag{27}$$

$$\text{in } F \quad : \quad \int_0^{a_{FF}} \pi_{FF}(a)\, dG(a) + \int_0^{a_{FH}} \pi_{FH}(a)\, dG(a) = F_E \tag{28}$$

Note that the endogenous mass of entrants implies that price indexes now write:

$$P_H = \left(\left(\tfrac{\sigma}{\sigma-1} \right)^{1-\sigma} \lambda \left(M_H a_{HH}^{1-\sigma+\rho} + \tau^{1-\sigma} M_F a_{FH}^{1-\sigma+\rho} \right) \right)^{\frac{1}{1-\sigma}} \tag{29}$$

$$P_F = \left(\left(\tfrac{\sigma}{\sigma-1} \right)^{1-\sigma} \lambda \left(M_F a_{FF}^{1-\sigma+\rho} + \tau^{1-\sigma} M_H a_{HF}^{1-\sigma+\rho} \right) \right)^{\frac{1}{1-\sigma}} \tag{30}$$

The zero cutoff profit (ZCP) conditions are as before:

$$\pi_{HH}(a_{HH}) = 0 \Leftrightarrow a_{HH} = \left(\tfrac{\sigma}{\sigma-1} \right)^{-1} \left(\frac{\mu}{\sigma(1+\beta_H) F} \right)^{\frac{1}{\sigma-1}} P_H \tag{31}$$

$$\pi_{HF}(a_{HF}) = 0 \Leftrightarrow a_{HF} = \left(\tfrac{\sigma}{\sigma-1} \right)^{-1} \tau^{-1} \left(\frac{\mu}{\sigma(\gamma+\beta_F) F} \right)^{\frac{1}{\sigma-1}} P_F \tag{32}$$

$$\pi_{FF}(a_{FF}) = 0 \Leftrightarrow a_{FF} = \left(\tfrac{\sigma}{\sigma-1} \right)^{-1} \left(\frac{\mu}{\sigma(1+\beta_F) F} \right)^{\frac{1}{\sigma-1}} P_F \tag{33}$$

$$\pi_{FH}(a_{FH}) = 0 \Leftrightarrow a_{FH} = \left(\tfrac{\sigma}{\sigma-1} \right)^{-1} \tau^{-1} \left(\frac{\mu}{\sigma(\gamma+\beta_H) F} \right)^{\frac{1}{\sigma-1}} P_H \tag{34}$$

Using these ZCP conditions allow to rewrite the 2 FE conditions as:

$$\text{in } H \quad : \quad a_{HH}^{\rho}\left(1+\beta_H\right)+a_{FF}^{\rho}\left(1+\beta_F\right)\Delta_F=\frac{F_E}{\left(\lambda-1\right)F} \tag{35}$$

$$\text{in } F \quad : \quad a_{FF}^{\rho}\left(1+\beta_F\right)+a_{HH}^{\rho}\left(1+\beta_H\right)\Delta_H=\frac{F_E}{\left(\lambda-1\right)F} \tag{36}$$

, where we use the notation $\Delta_H \equiv \tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}$ and $\Delta_F \equiv \tau^{-\rho}\left(\frac{1+\beta_F}{\gamma+\beta_F}\right)^{\frac{\rho}{\sigma-1}-1}$. Note that Δ_H, $\Delta_F \in (0,1)$ and that $\frac{\partial \Delta_H}{\partial \beta_H} < 0$ and $\frac{\partial \Delta_F}{\partial \beta_F} < 0$. Finally, note that if $\gamma = 1$, then $\Delta_H = \Delta_F = \tau^{-\rho}$.

These 2 FE conditions, together with the ZCP conditions allow to solve for the cutoffs:

$$\begin{array}{ll} a_{HH}^{\rho}=\frac{F_E}{(\lambda-1)(1+\beta_H)F}\frac{1}{1+\frac{1-\Delta_H}{1-\Delta_F}\Delta_F} & a_{HF}^{\rho}=\frac{F_E}{(\lambda-1)(\gamma+\beta_F)F}\frac{\Delta_F}{1+\frac{1-\Delta_F}{1-\Delta_H}\Delta_H} \\ a_{FF}^{\rho}=\frac{F_E}{(\lambda-1)(1+\beta_F)F}\frac{1}{1+\frac{1-\Delta_F}{1-\Delta_H}\Delta_H} & a_{FH}^{\rho}=\frac{F_E}{(\lambda-1)(\gamma+\beta_H)F}\frac{\Delta_H}{1+\frac{1-\Delta_H}{1-\Delta_F}\Delta_F} \end{array} \tag{37}$$

Mass of entrants

Using the ZCP and the price index expressions in Home and Foreign, we get:

$$\begin{aligned} \frac{\frac{\mu}{\sigma}}{\left(1+\beta_H\right)F\lambda} &= \left(M_H+M_F\Delta_H\right)a_{HH}^{\rho} \\ \frac{\frac{\mu}{\sigma}}{\left(1+\beta_F\right)F\lambda} &= \left(M_F+M_H\Delta_F\right)a_{FF}^{\rho} \end{aligned}$$

Equalizing the two and using cutoffs definitions, we obtain:

$$\frac{M_H}{M_F}=\frac{1-2\Delta_H+\Delta_H\Delta_F}{1-2\Delta_F+\Delta_H\Delta_F}$$

Going back the price index expression, we obtain:

$$M_H=\mu\frac{(\sigma-1)}{\sigma\rho F_E}\frac{1-2\Delta_H+\Delta_H\Delta_F}{1-\Delta_F-\Delta_H+\Delta_H\Delta_F} \tag{38}$$

$$M_F=\mu\frac{(\sigma-1)}{\sigma\rho F_E}\frac{1-2\Delta_F+\Delta_H\Delta_F}{1-\Delta_H-\Delta_F+\Delta_H\Delta_F} \tag{39}$$

Hence, the mass of entrants worldwide is constant:

$$M_H+M_F=2\mu\frac{(\sigma-1)}{\sigma\rho F_E} \tag{40}$$

It follows that:

$$\frac{\partial M_H}{\partial \beta_H}>0,\ \frac{\partial M_H}{\partial \beta_F}<0,\ \frac{\partial M_F}{\partial \beta_F}>0 \text{ and } \frac{\partial M_F}{\partial \beta_H}<0$$

An NTM at Home thus increases the mass of entrants at Home and decreases the mass of entrants in Foreign. Indeed, the NTM increases the market share of Home firms at Home,

expected profits rise generating new entry. The opposite is true in Foreign. To sum up, we get $\frac{\partial a_{HH}}{\partial \beta_H} < 0$; an NTM forces the least efficient domestic firms to exit, $\frac{\partial a_{HH}}{\partial \beta_F} > 0$; an NTM in the other country has a negative impact on welfare at Home, $\frac{\partial a_{FH}}{\partial \beta_H} < 0$; an NTM forces the least efficient foreign exporters to exit the Home market and $\frac{\partial a_{HF}}{\partial \beta_H} > 0$; an NTM allows less efficient firms to export, because of the lower mass of entrants in Foreign.

No macro distortion

Note that if $\gamma = 1$, an NTM does not alter aggregate market shares between Home and Foreign firms in the Home market. It implies that $\Delta_F = \Delta_H$, and the mass of firms is unresponsive to an NTM in each country, i.e. $M_H = \mu \frac{(\sigma-1)}{\sigma \rho F_E} = M_F \ \forall \beta_i$. Standards in that case reallocate market shares between foreign exporters but the foreign industry does not suffer as there is no protectionist effect. In turn, foreign welfare is not affected. Hence, in the absence of the macro distortion, there is no international inefficiency induced by NTMs.[39]

Welfare

In the model with free entry, income does not vary as profits in the industry are zero. Welfare variations are thus solely driven by the price index variations. To analyze the impact of an NTM at Home β_H on Home welfare, we use again the ZCP condition:

$$a_{HH}^{\rho} = \left(\tfrac{\sigma}{\sigma-1}\right)^{-\rho} \left(\frac{\mu}{\sigma\left(1+\beta_H\right)F}\right)^{\frac{\rho}{\sigma-1}} P_H^{\rho}$$

Using the equilibrium value of a_{HH}^{ρ} we get:

$$P_H^{\rho} = \frac{F_E\left(1-\Delta_F\right)}{\left(\lambda-1\right)F\left(\frac{\sigma}{\sigma-1}\right)^{-\rho}\left(\frac{\mu}{\sigma F}\right)^{\frac{\rho}{\sigma-1}}} \frac{\left(1+\beta_H\right)^{\frac{\rho}{\sigma-1}-1}}{\left(1-\Delta_F\Delta_H\right)}$$

Taking the derivative with respect to β_H:

$$\frac{\partial P_H^{\rho}}{\partial \beta_H} = -\left(\frac{\rho}{\sigma-1}-1\right) \frac{F_E\left(1-\Delta_F\right)}{\left(\lambda-1\right)F\left(\frac{\sigma}{\sigma-1}\right)^{-\rho}\left(\frac{\mu}{\sigma F}\right)^{\frac{\rho}{\sigma-1}}} \frac{1}{\left(1+\beta_H\right)^{\frac{\rho}{\sigma-1}}} \left(1-\Delta_F\Delta_H\frac{\left(1+\beta_H\right)}{\left(\gamma+\beta_H\right)}\right) \tag{41}$$

which implies:

$$\frac{\partial P_H^{\rho}}{\partial \beta_H} < 0$$

In the absence of a negative externality, an increase in β_H does not generate welfare gains because the variety effect dominates in this case too.

[39] This contrasts with Mei (2021) that uses a similar model, but with homogenous firms. In that case, all foreign firms export and pay the NTM at Home. Some foreign firms are thus forced to stop production. This international inefficiency is thus specific to models where all firms export.

A.2 Free entry in the one-sector model: endogenous wages.

Here, we introduce two changes to the model of the main text. First, we introduce a free entry condition exactly as in appendix A1 above. Thus firms need to pay an entry sunk cost F_E in order to draw their marginal cost from the distribution $G(a)$. There is thus no profits in equilibrium. Second, we consider a 1 sector economy. We thus assume that utility is given by:

$$U = C_M \ , \quad \text{with } C_M = \left(\int c_i^{1-\frac{1}{\sigma}} \right)^{\frac{1}{1-\frac{1}{\sigma}}} \tag{42}$$

Labor supply is inelastic, wages are thus endogenous. Second, as shown in Dhingra and Morrow (2019), the market equilibrium of this economy with only 1 sector and CES preferences is optimal (i.e. would be the one chosen by a social planner). As in appendix A1, we define M_H and M_F the mass of entrants in each market. We assume that firms pay the fixed costs in the destination country (NTMs need to be paid with local labor), this assumption is however innocuous for the results and could be reversed. Profits of a firm located in i and selling to j are thus given by:

$$\pi_{ij}(a) = \frac{w_j}{\sigma P_j^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} \tau_{ij} w_i a \right)^{1-\sigma} - w_j F_{ij}$$

There are 9 equilibrium conditions in the model. First, the two free entry (FE) are the same as in the 2 sectors model above:

$$\text{in } H \quad : \quad \int_0^{a_{HH}} \pi_{HH}(a)\, dG(a) + \int_0^{a_{HF}} \pi_{HF}(a)\, dG(a) = F_E \tag{43}$$

$$\text{in } F \quad : \quad \int_0^{a_{FF}} \pi_{FF}(a)\, dG(a) + \int_0^{a_{FH}} \pi_{FH}(a)\, dG(a) = F_E \tag{44}$$

The four zero cutoff profit (ZCP) conditions are given by:

$$\pi_{HH}(a_{HH}) = 0 \Leftrightarrow \frac{w_H}{\sigma P_H^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} w_H a_{HH} \right)^{1-\sigma} = w_H (1 + \beta_H) F \tag{45}$$

$$\pi_{HF}(a_{HF}) = 0 \Leftrightarrow \frac{w_F}{\sigma P_F^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} \tau w_H a_{HF} \right)^{1-\sigma} = w_F (\gamma + \beta_F) F \tag{46}$$

$$\pi_{FF}(a_{FF}) = 0 \Leftrightarrow \frac{w_F}{\sigma P_F^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} w_F a_{FF} \right)^{1-\sigma} = w_F (1 + \beta_F) F \tag{47}$$

$$\pi_{FH}(a_{FH}) = 0 \Leftrightarrow \frac{w_H}{\sigma P_H^{1-\sigma}} \left(\frac{\sigma}{\sigma - 1} \tau w_F a_{FH} \right)^{1-\sigma} = w_H (\gamma + \beta_H) F \tag{48}$$

The two labor market conditions (LMC) are given by:

$$\text{in H: } M_H\left(\int_0^{a_{HH}}\frac{w_H}{P_H^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_H\right)^{-\sigma}a^{1-\sigma}dG_H(a)+\int_0^{a_{HF}}\frac{w_F}{P_F^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_H\right)^{-\sigma}(\tau a)^{1-\sigma}dG_H(a)+F_E\right)$$
$$+M_H\int_0^{a_{HH}}(1+\beta_H)Fd G_H(a)+M_F\int_0^{a_{FH}}(\gamma+\beta_H)Fd G_H(a)=1 \quad (49)$$

$$\text{in F: } M_F\left(\int_0^{a_{FF}}\frac{w_F}{P_F^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_F\right)^{-\sigma}a^{1-\sigma}dG_F(a)+\int_0^{a_{FH}}\frac{w_F}{P_F^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_F\right)^{-\sigma}\tau a^{1-\sigma}dG_F(a)+F_E\right)$$
$$+M_F\int_0^{a_{FF}}(1+\beta_F)Fd G_F(a)+M_H\int_0^{a_{HF}}(\gamma+\beta_F)Fd G_F(a)=1 \quad (50)$$

And the trade balance (TB) is given by:

$$M_H\int_0^{a_{HF}}\frac{w_F}{P_F^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_H\tau a\right)^{1-\sigma}dG_H(a)=M_F\int_0^{a_{FH}}\frac{w_H}{P_H^{1-\sigma}}\left(\frac{\sigma}{\sigma-1}w_F\tau a\right)^{1-\sigma}dG_F(a) \quad (51)$$

Mass of entrants:

We first rewrite the FE condition, using the ZCP conditions:

$$\text{in H:}\qquad (1+\beta_H)a_{HH}^{\rho}+\frac{w_F}{w_H}(\gamma+\beta_F)a_{HF}^{\rho}=\frac{F_E}{F(\lambda-1)}$$
$$\text{in F}\quad :\quad (1+\beta_F)a_{FF}^{\rho}+\frac{w_H}{w_F}(\gamma+\beta_H)a_{FH}^{\rho}=\frac{F_E}{F(\lambda-1)}$$

We next rewrite the LMC condition, using ZCP and FE conditions:

$$M_HF_E(\rho+1)+M_H(1+\beta_H)Fa_{HH}^{\rho}+M_F(\gamma+\beta_H)Fa_{FH}^{\rho}=1$$

The price index definition in H implies (with the use of the ZCP):

$$\frac{1}{\sigma\lambda}=M_H(1+\beta_H)Fa_{HH}^{\rho}+M_F(\gamma+\beta_H)Fa_{FH}^{\rho}$$

Plugging this back to LMC, we obtain the mass of entrants in each country:

$$M_H = \frac{(\sigma-1)}{\sigma\rho F_E} \quad (52)$$
$$M_F = \frac{(\sigma-1)}{\sigma\rho F_E} \quad (53)$$

We can now rewrite LMC in H as:

$$(1+\beta_H)a_{HH}^{\rho}+(\gamma+\beta_H)a_{FH}^{\rho}=\frac{F_E}{(\lambda-1)F} \quad (54)$$

This expression shows how labor is divided between Home and Foreign firms (that pay the export fixed cost and the NTM with Home labor).

The ZCP conditions giving $a_{FH}^{\rho} = a_{HH}^{\rho} \left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}} \left(\frac{w_H}{\tau w_F}\right)^{\rho}$, we obtain:

$$a_{HH}^{\rho} = \frac{F_E}{(\lambda-1)F} \frac{1}{(1+\beta_H)} \frac{1}{\left(1+\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}\left(\frac{w_H}{w_F}\right)^{\rho}\right)} \tag{55}$$

and:

$$a_{FF}^{\rho} = \frac{F_E}{(\lambda-1)F} \frac{1}{(1+\beta_F)} \frac{1}{\left(1+\tau^{-\rho}\left(\frac{1+\beta_F}{\gamma+\beta_F}\right)^{\frac{\rho}{\sigma-1}-1}\left(\frac{w_F}{w_H}\right)^{\rho}\right)} \tag{56}$$

Note that the two cutoffs do not depend directly on the NTM of the other country. It is only through the labor market and thus the relative wage that the other NTM matters. Compared to the main text, the main difference is the relative wage term. Part of the market share reallocation from Foreign to Home firms is absorbed by the relative wage increase, which reduces the relative competitiveness of Home firms (both in the Home and Foreign market).

Relative wage:

Finally, the TB allows to assess the impact of an NTM on the relative wage. Using the ZCP conditions and the equilibrium LMC, TB can be written:

$$\frac{(\sigma-1)}{\sigma\rho}\frac{L_H}{F_E}\sigma w_F F_{HF}\lambda a_{HF}^{\rho} = \frac{(\sigma-1)}{\sigma\rho}\frac{L_F}{F_E}\sigma w_H F_{FH}\lambda a_{FH}^{\rho}$$

which yields:

$$\frac{w_F}{w_H} = \frac{1+\left(\frac{w_F}{w_H}\right)^{-\rho}\tau^{\rho}\left(\frac{\gamma+\beta_F}{1+\beta_F}\right)^{\frac{\rho}{\sigma-1}-1}}{1+\left(\frac{w_F}{w_H}\right)^{\rho}\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}} \tag{57}$$

The RHS of this equation is strictly decreasing in $\frac{w_F}{w_H}$, while the LHS is increasing. This equation thus defines a unique equilibrium. Given β_F, an increase in β_H decreases the RHS, leading to a decrease $\frac{w_F}{w_H}$ and thus an increase relative wage for home:

$$\frac{\partial\left(\frac{w_H}{w_F}\right)}{\partial\beta_H} > 0$$

The mechanism thus still works the same way. An NTM reallocates market shares towards domestic firms in the local market. Hence, this generates an increase in labor demand, increasing relative wages in the domestic market.

No macro distortion

Note that if $\gamma = 1$, an NTM does not alter aggregate market shares between Home and Foreign firms in the Home market. Relative wage is then given by:

$$\frac{w_F}{w_H} = \frac{\left(\frac{w_F}{w_H}\right)^{-\rho}\tau^{\rho}+1}{\left(\frac{w_F}{w_H}\right)^{\rho}\tau^{\rho}+1} \tag{58}$$

which implies $\frac{w_F}{w_H} = 1$. An NTM forces the least efficient firms (both Home and Foreign firms) to exit the Home market, reducing the mass of varieties available to consumers. But the labor used by Home and Foreign firms to serve the Home market does not change (the most efficient firms use more labor). Hence, the labor market in both countries is unaffected and Foreign welfare does not change. In the absence of the macro distortion, there is thus no international inefficiency induced by the NTM.

Welfare

Welfare is given by $\frac{w_H}{P_H}$. We have

$$P_H^{1-\sigma} = \frac{(\sigma-1)\,\lambda}{\sigma\rho F_E}\left(\left(\frac{\sigma}{\sigma-1}w_H\right)^{1-\sigma} a_{HH}^{1-\sigma+\rho} + \left(\frac{\sigma}{\sigma-1}\tau w_F\right)^{1-\sigma} a_{FH}^{1-\sigma+\rho}\right)$$

Expressing cutoffs as function of the price index we obtain:

$$\begin{aligned}\left(\frac{w_H}{P_H}\right)^{\rho} &= \frac{\lambda}{\rho F_E\left(\frac{\sigma}{\sigma-1}\right)^{\rho+1}(\sigma F)^{\frac{\rho}{\sigma-1}-1}(1+\beta_H)^{\frac{\rho}{\sigma-1}}}(1+\beta_H)\left(1+\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}\left(\frac{w_H}{w_F}\right)^{\rho}\right) \\ &= \frac{1}{\left(\frac{\sigma}{\sigma-1}\right)^{\rho}(\sigma F)^{\frac{\rho}{\sigma-1}}}\frac{1}{(1+\beta_H)^{\frac{\rho}{\sigma-1}-1}}\frac{1}{(1+\beta_H)\,a_{HH}^{\rho}} \qquad (59)\end{aligned}$$

Note that $(1+\beta_H)\,a_{HH}^{\rho}$ is increasing in β_H, as it captures the part of Home labor used by Home firms. Thus:

$$\frac{\partial\left(\frac{w_H}{P_H}\right)}{\partial\beta_H} < 0$$

In the absence of a negative externality, an increase in β_H does not generate welfare gains because the variety effect dominates in this case too.

B NTMs affecting fixed costs: alternatives

B.1 Fixed costs increasing with firm size

In this appendix, we consider the case where fixed costs increase with firm size. This implies that NTMs are still non-discriminatory, but are more expensive for larger firms (both Home and Foreign). This could be the case for example if adjusting the production chain/process to the new NTM is more complicated for firms producing more. We assume for simplicity that fixed costs Home firms have to pay to sell in the Home market are $Fa_i^{1-\kappa}$ while foreign firms pay $\gamma F a_i^{1-\kappa}$, with $1 < \kappa < \sigma$. NTMs are thus costlier for larger firms. As $\kappa < \sigma$, fixed costs increase with size, but less than proportionally. If $\kappa = \sigma$, fixed costs would be proportional to size (i.e. they would become variable costs) and there would be no selection of firms into export markets, while if $\kappa > \sigma$, selection would be reversed: profits would increase with firms' marginal costs.

Profits in the Home market thus write:

$$\pi_{HH}(a_i) = \frac{\mu}{\sigma} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} a_i^{1-\sigma} - (1+\beta_H) F a_i^{1-\kappa} \tag{60}$$

$$\pi_{FH}(a_i) = \frac{\mu}{\sigma} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \tau^{1-\sigma} a_i^{1-\sigma} - (\gamma+\beta_H) F a_i^{1-\kappa} \tag{61}$$

The zero cutoff profit (ZCP) conditions become:

$$\pi_{HH}(a_{HH}) = 0 \Leftrightarrow a_{HH}^{\sigma-\kappa} = \frac{\mu}{\sigma(1+\beta_H)F} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \tag{62}$$

$$\pi_{FH}(a_{FH}) = 0 \Leftrightarrow a_{FH}^{\sigma-\kappa} = \frac{\mu}{\sigma(\gamma+\beta_H)F} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \tau^{1-\sigma} \tag{63}$$

Using the definition of the price index, we can compute the two cutoffs in the Home market:

$$a_{HH}^{1-\kappa+\rho} = \frac{\mu}{\sigma\lambda F} \frac{1}{(1+\beta_H)} \frac{1}{\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}}\right)} \tag{64}$$

$$a_{FH}^{1-\kappa+\rho} = \frac{\mu}{\sigma\lambda F} \frac{1}{(1+\beta_H)} \frac{\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\kappa+\rho}{\sigma-\kappa}}}{\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}}\right)} \tag{65}$$

Aggregate profits are thus given by:

$$\begin{aligned}\Pi_{HH} &= \int_0^{a_{HH}} \frac{\mu}{\sigma} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} a^{1-\sigma} dG(a) - \int_0^{a_{HH}} (1+\beta_H) F a^{1-\kappa} dG(a) \\ &= \frac{\mu}{\sigma}\left(\frac{\sigma-\kappa}{1-\kappa+\rho}\right) \frac{1}{1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}}}\end{aligned} \tag{66}$$

$$\begin{aligned}\Pi_{FH} &= \int_0^{a_{FH}} \frac{\mu}{\sigma} P_H^{\sigma-1} \left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} \tau^{1-\sigma} a^{1-\sigma} dG(a) - \int_0^{a_{FH}} (\gamma+\beta_H) F a^{1-\kappa} dG(a) \\ &= \frac{\mu}{\sigma}\left(\frac{\sigma-\kappa}{1-\kappa+\rho}\right) \frac{\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}} \tau^{1-\sigma}}{1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}}}\end{aligned} \tag{67}$$

Due to the Pareto distribution, we still have that aggregate profits in each market are constant:

$$\Pi_{HH} + \Pi_{FH} = \frac{\mu}{\sigma}\left(\frac{\sigma-\kappa}{1-\kappa+\rho}\right) \tag{68}$$

The aggregate profit shifting induced by an NTM is given by:

$$\frac{\partial \Pi_{HH}}{\partial \beta_H} = (1-\gamma)\frac{\mu}{\sigma}\left(\frac{1-\sigma+\rho}{1-\kappa+\rho}\right)\frac{\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\kappa+\rho}{\sigma-\kappa}}}{(1+\beta_H)^2\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-\kappa}}\right)^2} \tag{69}$$

which has the same properties as the expression in the main text with fixed costs independent of size.

B.2 Proportional fixed costs without Pareto

In this appendix, we consider the model as in the main text except that we drop the assumption that $G(a)$ is Pareto. We show how an NTM that increases fixed costs in a proportional way can generate a profit shifting between Home and Foreign firms. Note that an equal fixed costs increase, as analyzed in the main text, would also shift profits in this case because it would still affect the ratio $\frac{a_{FH}}{a_{HH}}$, on top of the effect explained below.

We consider here the case where the fixed cost paid by Home firms increases by an amount $\beta_H F$ and the fixed cost paid by Foreign firms by $\beta_H \gamma F$. Aggregate profits of Home firms in the Home market are given by:

$$\begin{aligned}\Pi_{HH}(\beta_H, P_H) &= \frac{\mu}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} P_H^{\sigma-1}\int_0^{a_{HH}} a_i^{1-\sigma} dG(a) - \beta_H F\int_0^{a_{HH}} dG(a) \\ &= \frac{\mu}{\sigma}\left(1+\tau^{1-\sigma}\frac{\int_0^{a_{FH}} a^{1-\sigma}dG(a)}{\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)}\right)^{-1} - \beta_H F\int_0^{a_{HH}} dG(a)\end{aligned} \tag{70}$$

An NTM at Home thus affects aggregate profits of Home firms Π_{HH} through two effects. First, it may increase the domestic trade share $\left(1+\tau^{1-\sigma}\frac{\int_0^{a_{FH}} a^{1-\sigma}dG(a)}{\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)}\right)^{-1}$, i.e. the aggregate market share of Home firms at Home. Second, it may affect the aggregate fixed costs paid by Home firms that are operating: $\beta_H F\int_0^{a_{HH}} dG(a)$. When $G(a)$ is Pareto, both terms are constant and a proportional fixed cost increase does not affect aggregate profits.

1) Market share shifting

We get:

$$\frac{\partial \frac{\int_0^{a_{FH}} a^{1-\sigma}dG(a)}{\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)}}{\partial \beta_H} = \frac{a_{FH}^{1-\sigma} g(a_{FH})\frac{\partial a_{FH}}{\partial \beta_H}\int_0^{a_{HH}} a_i^{1-\sigma}dG(a) - \int_0^{a_{FH}} a^{1-\sigma}dG(a) a_{HH}^{1-\sigma} g(a_{HH})\frac{\partial a_{HH}}{\partial \beta_H}}{\left(\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)\right)^2}$$

$$\frac{\partial \frac{\int_0^{a_{FH}} a^{1-\sigma}dG(a)}{\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)}}{\partial \beta_H} < 0 \Longleftrightarrow a_{FH}\frac{a_{FH}^{1-\sigma} g(a_{FH})}{\int_0^{a_{FH}} a^{1-\sigma}dG(a)} > a_{HH}\frac{a_{HH}^{1-\sigma} g(a_{HH})}{\int_0^{a_{HH}} a_i^{1-\sigma}dG(a)} \tag{71}$$

If this last inequality is respected, the domestic trade share increases after an NTM and

this increases operating profits of domestic firms in the domestic market. Note that this is simply comparing hazard rates of domestic and foreign firms, weighted by their market shares. Therefore, this inequality is respected when, at the margin, the market share of domestic firms that are forced to exit is larger than the one of foreign firms. Note that under Pareto, this is always an equality, no matter $\frac{a_{FH}}{a_{HH}}$ as these weighted hazard rates are constant.

2) Aggregate profits.

The other effect is not a profit shifting effect between domestic and foreign firms. With an increase in β_H, some domestic firms exit (as well as foreign firms) and stop paying a fixed cost while the remaining ones pay a larger fixed cost. Away from Pareto, and even under autarky, an increase in fixed costs may increase or decrease aggregate profits because one of these effects would dominate. Note that it is thus possible to have a policy of increasing fixed costs that would increase aggregate profits of both domestic and foreign firms. Taking the viewpoint of Home firms (the analysis is equivalent for Foreign firms), the question is how an increase in β_H affects the aggregate fixed costs paid by Home firms that stay active: $\int_0^{a_{HH}} \beta_H F dG(a)$. Using the fact that $\frac{\partial a_{HH}}{\partial \beta_H}\frac{\beta_H}{a_{HH}} = -\left(\frac{1}{\sigma-1} - \frac{\partial P_H}{\partial \beta_H}\frac{\beta_H}{P_H}\right)$, we get:

$$\frac{\partial \int_0^{a_{HH}} \beta_H F dG(a)}{\partial \beta_H} = -FG(a_{HH}) + Fa_{HH}g\left(a_{HH}\right)\left(\frac{1}{\sigma-1} - \frac{\partial P_H}{\partial \beta_H}\frac{\beta_H}{P_H}\right) \tag{72}$$

The first effect on aggregate fixed costs is negative, illustrating the increase in fixed costs for survivors. The second effect is positive, because some firms exit and thus less fixed costs are paid. How many firms do exit depends on the price index reaction $\frac{\partial P_H}{\partial \beta_H}\frac{\beta_H}{P_H}$. In other words, to what extent the exit of firms around a_{HH} reduces competition? The more it reduces competition, the less exit implied by β_H at the margin. Using the definition of the price index, we obtain:

$$\frac{\partial P_H}{\partial \beta_H}\frac{\beta_H}{P_H} = \frac{1}{(\sigma-1)}\frac{1}{1 + \frac{1}{\frac{1}{\sigma-1}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} P_H^{\sigma-1} a_{HH}^{2-\sigma}\left(g(a_{HH}) + \gamma^{\frac{\sigma-2}{\sigma-1}}\tau^{-1}g(a_{FH})\right)}} < \frac{1}{\sigma-1}$$

which leads to:

$$\frac{\partial \int_0^{a_{HH}} \beta_H F dG(a)}{\partial \beta_H} < 0 \Longleftrightarrow G(a_{HH}) < \frac{1}{\sigma-1}\left(\frac{g\left(a_{HH}\right)}{1 + \frac{1}{\sigma-1}a_{HH}^{1-\sigma}\frac{g(a_{HH}) + \gamma^{\frac{\sigma-2}{\sigma-1}}\tau^{-1}g(a_{FH})}{\int_0^{a_{HH}} a^{1-\sigma}dG(a) + \tau^{1-\sigma}\int_0^{a_{FH}} a^{1-\sigma}dG(a)}}\right) \tag{73}$$

First, note that the larger $g\left(a_{HH}\right)$ compared to $G(a_{HH})$, the more aggregate fixed costs are saved because more firms exit. The term $\frac{g(a_{HH}) + \gamma^{\frac{\sigma-2}{\sigma-1}}\tau^{-1}g(a_{FH})}{\int_0^{a_{HH}} a^{1-\sigma}dG(a) + \tau^{1-\sigma}\int_0^{a_{FH}} a^{1-\sigma}dG(a)}$ tells us how competitive the firms exiting at the margin are (both domestic and foreign), compared to the rest of the competitors. The larger this term, the lower the exit and thus the lower the fixed costs savings. Note that the larger this term, the larger $g\left(a_{HH}\right)$ and $g\left(a_{FH}\right)$ are compared to $\int_0^{a_{HH}} a^{1-\sigma}dG(a) + \tau^{1-\sigma}\int_0^{a_{FH}} a^{1-\sigma}dG(a)$.

C Direct positive effect of NTMs on welfare

In this appendix, we leave aside the political economy motives for protection. We consider instead that NTMs can reduce a negative externality and thus have a direct positive effect on welfare. The purpose is to show that the protectionist effect of NTMs leads in that case governments to overregulate (i.e. to choose too stringents NTMs) compared to what would be optimal. Moreover, in the absence of a protectionist effect of NTMs, there is no other inefficiency and the equilibrium choice of NTMs is optimal.

For simplicity, we follow here Staiger and Sykes (2011, 2021) and Mei (2021) and assume the existence of a negative externality that does not affect demand. The impact of NTMs on the market equilibrium is thus left unchanged compared to the main text. We assume that the impact of the negative externality on welfare is captured by $E(\beta_H)$. The welfare function thus now writes:

$$W_H(\beta_H, \beta_F) = \Pi_H(\beta_H, \beta_F) + 1 + S_H(\beta_H) - E(\beta_H) \tag{74}$$

with $\Pi_H(\beta_H, \beta_F) = \Pi_{HH}(\beta_H) + \Pi_{HF}(\beta_F)$ and $S_H(\beta_H) = \mu \ln \frac{\mu}{P_H} - \mu$, as before.

We assume that $E(0) = \infty$, $E'(\beta_H) < 0$ and $E''(\beta_H) > 0$. Hence, an increase in β_H reduces the negative externality, i.e. NTMs have a direct positive impact on welfare. These conditions also ensure that there is always an incentive to implement some NTMs and that we get an interior solution.

The objective function of the (Home) government is here fully aligned with social welfare:

$$G_H(\beta_H, \beta_F) = W_H(\beta_H, \beta_F) \tag{75}$$

Compared to the model in the main text, governments have reasons to implement some NTMs beyond their protectionist effect because they act against the negative externality $E(\beta_H)$. The decision of the Home government in the non-cooperative equilibrium is given by:

$$\frac{\partial \Pi_H(\beta_H, \beta_F)}{\partial \beta_H} + \frac{\partial S_H(\beta_H)}{\partial \beta_H} = \frac{\partial E(\beta_H)}{\partial \beta_H} \tag{76}$$

As long as $\gamma < 1$, NTMs generate the same profit shifting effect as in the main text (the market equilibrium is the same):

$$\frac{\partial \Pi_H(\beta_H, \beta_F)}{\partial \beta_H} > 0 \text{ if } \gamma < 1.$$

Hence, governments implement NTMs for two reasons: the negative externality and the profit shifting effect. This implies that in the equilibrium, we have:

$$\frac{\partial E(\beta_H)}{\partial \beta_H} > \frac{\partial S_H(\beta_H)}{\partial \beta_H} \tag{77}$$

This solution is inefficient: the foreign country takes the same decision, there is thus no

income gain through the profit shifting and countries are therefore trapped in a prisoner's dilemma in the non-cooperative equilibrium. Governments choose norms and standards that are too stringent compared to what is efficient; the problem of inefficient NTMs thus arises also in the case of a benevolent individual-country policy maker.

Moreover, note that in the absence of a protectionist effect of NTMs, i.e. $\gamma = 1$, we get $\frac{\partial \Pi_H}{\partial \beta_H} = 0$. It follows that the unique reason to implement NTMs in this case would be the negative externality. The choice of the government would then be the first best, governments introduce some NTMs up to the point their negative effect on consumer surplus dominates the positive effect induced by the reduction of the negative externality:

$$\frac{\partial S_H(\beta_H)}{\partial \beta_H} = \frac{\partial E(\beta_H)}{\partial \beta_H} \tag{78}$$

There is thus no inefficiency beyond the protectionist effect.

D Non-cooperative equilibrium - symmetric countries

The decision of the Home government is given by:

$$\frac{\partial \Pi_{HH}(\beta_H)}{\partial \beta_H} + \alpha \frac{\partial S_H(\beta_H)}{\partial \beta_H} = 0$$

The consumer surplus may be written as $S_H(\beta_H) = \mu \ln \mu - \mu + \frac{\mu}{\sigma - 1} \ln P_H^{1-\sigma}$. We obtain:

$$\frac{\partial S_H}{\partial \beta_H} = -\frac{\mu}{\sigma \lambda} \frac{\sigma}{\sigma - 1} \frac{1 + \tau^{-\rho} \left(\frac{1+\beta_H}{\gamma + \beta_H} \right)^{\frac{\rho}{\sigma-1}}}{(1+\beta_H) \left(1 + \tau^{-\rho} \left(\frac{1+\beta_H}{\gamma+\beta_H} \right)^{\frac{\rho}{\sigma-1}-1} \right)} \tag{79}$$

$$\frac{\partial \Pi_{HH}}{\partial \beta_H} = (1-\gamma) \frac{\mu}{\sigma \lambda} \frac{\tau^{-\rho} \left(\frac{1+\beta_H}{\gamma+\beta_H} \right)^{\frac{\rho}{\sigma-1}}}{(1+\beta_H)^2 \left(1 + \tau^{-\rho} \left(\frac{1+\beta_H}{\gamma+\beta_H} \right)^{\frac{\rho}{\sigma-1}-1} \right)^2} \tag{80}$$

It follows directly that β_H^{NC} is given by:

$$\frac{\sigma - 1}{\alpha \sigma} = \frac{1 + \beta_H^{NC}}{1 - \gamma} \left(1 + \tau^{1-\sigma} \left(\frac{1 + \beta_H^{NC}}{\gamma + \beta_H^{NC}} \tau^{1-\sigma} \right)^{\frac{\rho}{\sigma-1}-1} \right) \left(1 + \left(\frac{\gamma + \beta_H^{NC}}{1 + \beta_H^{NC}} \tau^{\sigma-1} \right)^{\frac{\rho}{\sigma-1}} \right)$$

This defines a unique equilibrium as the RHS is monotonically increasing in β_H^{NC} (see below). Note that this equation has no solution if $\alpha = 1$, illustrating the fact that the effect of β_H^{NC} on the consumer surplus is always larger than on income.

Trade openness.

Call $F(\beta_H)$ the RHS of the expression above (which is (15) in the main text):

$$\begin{aligned} F(\beta_H) &= \frac{1+\beta_H}{1-\gamma}\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}\right)\left(1+\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)^{\frac{\rho}{\sigma-1}}\right) \\ &= \frac{1+\beta_H}{1-\gamma}\left(1+\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}+\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}}+\frac{\gamma+\beta_H}{1+\beta_H}\right) \end{aligned} \tag{81}$$

We get:

$$\frac{\partial F(\beta_H)}{\partial \beta_H} = \frac{1}{1-\gamma}\left(\begin{array}{l} 2+\frac{\rho}{\sigma-1}\left(\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}+\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}\right) \\ -\left(\frac{\rho}{\sigma-1}-1\right)\left(\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}}+\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}}\right) \end{array}\right) > 0 \tag{82}$$

$$\frac{\partial F(\beta_H)}{\partial \tau} = \frac{1+\beta_H}{1-\gamma}\rho\left(\tau^{\rho-1}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}}-\tau^{-\rho-1}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}\right) > 0 \tag{83}$$

$\frac{\partial F(\beta_H)}{\partial \beta_H} > 0$ implies that (15) defines a unique equilibrium. Moreover, as $\frac{\partial F(\beta_H)}{\partial \tau} > 0$, trade liberalization (a decrease in τ) increases the equilibrium NTM β_H^{NC}.

Proof:

$$\begin{aligned} \frac{\partial F(\beta_H)}{\partial \tau} &> 0 \Leftrightarrow \tau^{\rho-1}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}}-\tau^{-\rho-1}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}>0 \\ &\Leftrightarrow 1>\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{2\rho+1-\sigma}{\sigma-1}} \end{aligned}$$

A sufficient condition for $\frac{\partial F}{\partial \beta_H} > 0$ is:

$$\begin{aligned} \tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}+\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1} &> \tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}}+\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}} \\ \Leftrightarrow 1 &> \tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{2\rho}{\sigma-1}-1} \end{aligned}$$

As $\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right) < 1$, the equilibrium level of β_H is larger the smaller τ is.

Impact of γ on β_H:

$$\begin{aligned} \frac{\partial F(\beta_H)}{\partial \gamma} &= \frac{1+\beta_H}{(1-\gamma)^2}\left(1+\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{1-\sigma+\rho}{\sigma-1}}\right)\left(1+\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)^{\frac{\rho}{\sigma-1}}\right) \\ &+\frac{1+\beta_H}{1-\gamma}\left(\frac{1}{(1+\beta_H)}\right)\left(\frac{\rho}{\sigma-1}\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}+1-\left(\frac{\rho}{\sigma-1}-1\right)\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}}\right) \end{aligned} \tag{84}$$

A sufficient condition for $\frac{\partial F(\beta_H)}{\partial \gamma} > 0$ is the last term to be positive. We get:

$$\left(\frac{\rho}{\sigma-1}\tau^{\rho}\left(\frac{\gamma+\beta_H}{1+\beta_H}\right)^{\frac{\rho}{\sigma-1}-1}+1-\left(\frac{\rho}{\sigma-1}-1\right)\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}}\right) > 0$$

$$\rho\left(\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)^{\frac{\rho}{\sigma-1}}-\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}}\right)+(\sigma-1)\left(1+\tau^{-\rho}\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)^{\frac{\rho}{\sigma-1}}\right) > 0$$

As $\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)<1$, $\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)>1$ and the first term is positive. Hence $\frac{\partial F(\beta_H)}{\partial \gamma} > 0$ and the equilibrium level of β_H^{NC} is larger the smaller γ.

Impact of σ on β_H:

$$\frac{\partial F(\beta_H)}{\partial \sigma} = -\frac{(1+\beta_H)}{1-\gamma}\left(\frac{\rho}{(\sigma-1)^2}\right)\ln\left(\frac{1+\beta_H}{\gamma+\beta_H}\right)\left(\tau^{1-\sigma}\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)^{\frac{\rho}{\sigma-1}-1}-\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)^{\frac{\rho}{\sigma-1}}\right) \quad (85)$$

As $\left(\frac{1+\beta_H}{\gamma+\beta_H}\tau^{1-\sigma}\right)<1$ and $\left(\frac{\gamma+\beta_H}{1+\beta_H}\tau^{\sigma-1}\right)>1$, the last term is negative. Hence $\frac{\partial F(\beta_H)}{\partial \sigma} > 0$ and the equilibrium level of β_H^{NC} is larger the smaller σ.

E Cooperative equilibrium - asymmetric countries

To get a Pareto improvement, we need the following two conditions to be fulfilled:

$$(1)\ \Delta G_H(\beta_H,\beta_F) \geq 0 \Leftrightarrow \Delta\Pi_H(\beta_H,\beta_F) + \alpha\Delta S_H(\beta_H) \geq 0$$
$$(2)\ \Delta G_F(\beta_F,\beta_H) \geq 0 \Leftrightarrow \alpha\Delta S_F(\beta_F) - \Delta\Pi_H(\beta_H,\beta_F) \geq 0$$

We show here the necessary conditions for these conditions to be respected. First, note that conditions (1) and (2) imply $\Delta G_H(\beta_H,\beta_F) + \Delta G_F(\beta_F,\beta_H) \geq 0$. As the profit shifting is a zero sum game, we thus need:

$$\Delta S_F(\beta_F) + \Delta S_H(\beta_H) \geq 0$$

Second, for condition (2) to be respected, we need:

$$\alpha\Delta S_F(\beta_F) \geq \Delta\Pi_H(\beta_H,\beta_F)$$

Recall that $\Delta S_F(\beta_F) = S_F\left(\beta_F^{CE}\right) - S_F(\beta_F^{NC})$. As $\frac{\partial S_F(\beta_F)}{\partial \beta_F} < 0$ and $\beta_F^{NC} = 0$, we necessarily have $\Delta S_F(\beta_F) \leq 0$, which means that the Foreign country has to provide some more market access to Home firms in its domestic market. it follows that:

$$\Delta\Pi_H(\beta_H,\beta_F) \leq 0$$

For condition (1) to be respected, we need:

$$\alpha \Delta S_H(\beta_H) \geq -\Delta \Pi_H \left(\beta_H, \beta_F\right)$$

As $\Delta \Pi_H \left(\beta_H, \beta_F\right) < 0$, it follows:

$$\Delta S_H(\beta_H) \geq 0$$

To sum up, the necessary conditions to get a Pareto improvement are:

$$\begin{aligned} \Delta S_F(\beta_F) + \Delta S_H(\beta_H) &\geq 0 && (86) \\ \Delta S_H(\beta_H) &\geq 0 && (87) \\ \Delta S_F(\beta_F) &\leq 0 && (88) \\ \Delta \Pi_H \left(\beta_H, \beta_F\right) &\leq 0 && (89) \end{aligned}$$