Are Trade Agreements Good for You?[*]

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Abstract

We examine how trade agreements affect global welfare when they are influenced by producer lobbies. A "shallow" agreement that deals only with trade policies tends to be good for you, as it pits exporter lobbies against import-competing lobbies. But the impacts of "deep" agreements that focus on domestic policies are different: they tend to be bad for you when they deal with consumption-side policies and good for you when they deal with production-side policies, at least when lobbying pressures are strong. This is because the interests of domestic and foreign producers are aligned when it comes to consumption-side policies, while they collide when it comes to production-side policies. The presence of international ownership linkages tends to worsen the welfare implications of trade agreements, because it reduces the distortions in unilateral policies while it has little effect on cooperative policies.

1 Introduction

After decades of trade liberalization, tariffs have reached historically low levels, so there is only limited scope for further tariff reductions. As a result, modern trade agreements now largely revolve around non-tariff issues in an attempt to achieve additional economic integration. For instance, many trade agreements now establish regulatory cooperation councils through which national regulatory agencies can coordinate their policies. This applies, for example, to the recent Comprehensive Economic and Trade Agreement (CETA) between the EU and Canada or the proposed Transatlantic Trade and Investment Partnership (TTIP) between the EU and the US.[1]

Such deep integration agreements are very controversial, as evidenced for example by the massive protests against CETA and TTIP in Europe, which drew hundreds of thousands of people to the streets. While some opponents criticize any form of economic globalization, most object specifically to the deep integration elements. The overarching concern is that trade agreements get hijacked by special interests, thus benefiting businesses at the expense of society. For example, a common claim is that big corporations exert disproportionate influence on regulatory cooperation bodies, thereby undermining consumer safety and endangering the environment.[2] A case in point was the public uproar against allowing the sale of chlorine-washed chicken in Europe, which had been banned earlier by the EU over food safety concerns.

These concerns are shared by some academic economists. For example, in a recent paper Rodrik (2018) argues informally that shallow integration is likely to enhance welfare because it empowers exporter lobbies and pits them against import-competing interests, but he warns that deep integration may be detrimental to welfare because it empowers the 'wrong' special interests.

In this paper we take such concerns seriously and examine formally whether trade agreements negotiated under pressures from industry lobbies improve welfare ('are good for you'). We consider both shallow agreements, which deal only with trade policies, and deep agreements, which also cover domestic regulations.

The reference point of our analysis is the canonical 'trade wars and trade talks' model of Grossman and Helpman (1995a), which examines non-cooperative and cooperative trade pol-

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[1]Other examples include the Canada-US Regulatory Cooperation Council, the U.S.-Mexico High Level Regulatory Cooperation Council, and the Trans-Tasman Mutual Recognition Agreement between Australia and New Zealand.

[2]Statements along these lines can be found in activist websites such as www.stop-ttip.org.

icy choices by governments who are subject to lobbying pressures, and the subsequent work by Bagwell and Staiger (1999, 2001). A fundamental feature of the canonical model is that there is no political economy rationale for trade negotiations, in the sense that the only purpose of trade negotiations is to prevent countries from manipulating terms of trade. Another important feature of the canonical model – and of virtually all political economy models of trade policy – is that it assumes away production subsidies, since otherwise countries would not distort trade policies in response to lobbying pressures.

Our approach differs from the canonical one in three main ways. First, we consider a continuum of small countries rather than two large countries. This allows us to put lobbying at the heart of trade negotiations, as small countries have no ability to manipulate terms of trade.

Second, in addition to assuming away production subsidies just as in the canonical model, we assume that countries do not have access to export subsidies. Export subsidies were banned by GATT a long time ago, so we take this restriction as a fact of life. Absent export subsidies, we will show that lobbying pressures play a central role in trade negotiations. Intuitively, if countries could use export subsidies they would be able to help their exporters and would not need to negotiate tariff reductions on their behalf.[3]

Third, in order to examine how politically-motivated agreements affect welfare, we distinguish between the governments' "positive" objectives and a "normative" objective. Most existing models adopt the same government objective function to predict and evaluate trade policy choices, thus they cannot address the widespread concern that trade agreements benefit special interests at the expense of society.[4]

Our first main result is that shallow integration is good for you, except if it leads to large import subsidies (which does not seem an empirically relevant case). The reason is that trade negotiations empower exporter lobbies, which then act as counterweight to import-competing lobbies and thereby dilute the overall effect of special interests on trade policy. In the non-cooperative equilibrium, exporter lobbies do not influence trade policy choices because a country's own tariffs can only help its import-competing producers. But this changes in the

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[3]The feature that lobbying is key to the purpose of a trade agreement is present also in the models by Maggi and Rodriguez-Clare (1998, 2007) and Maggi (2019). But these papers make very different points than our paper, and they do not address deep agreements.

[4]Notable exceptions are Grossman and Helpman (1995b) and Ornelas (2005, 2008), who discuss whether politically-viable regional trade agreements are likely to cause more trade diversion or creation, and thus whether they are likely to increase or reduce welfare. But they do not address either deep agreements or multilateral shallow agreements.

cooperative equilibrium, since the trading partners' tariffs become part of the bargain and a country's exporters benefit from increased market access elsewhere.[5]

We then turn to deep integration. It is worth highlighting that in the canonical terms-of-trade model there is no scope for deep agreements, as long as a shallow agreement includes rules that prevent countries from using domestic policies to manipulate terms-of-trade (Bagwell and Staiger, 2001, Ederington, 2001).[6] In our setting, on the other hand, if governments can use behind-the-border policies there *is* scope for deep integration.

Our second main result is that deep integration is bad for you if it addresses consumption side policies, at least in a world in which lobbying forces are sufficiently strong. By consumption side policies we mean policies that apply to locally-consumed products, such as product standards or consumption taxes. The intuition is that in this case the interests of producers world-wide are aligned, so the possibility of cooperation strengthens the overall effect of lobbies on policy. In particular, a loosening of product standards in one country benefits producers world-wide, since it stimulates consumption and increases world prices.

Our third main result is that deep integration tends to be good for you if it addresses production side policies. By production side policies we mean policies that apply to local production, such as production regulations and production taxes. The reason is that, as in the case of shallow integration, the negotiation of a deep agreement triggers countervailing lobbying, but the cleavages that arise across the lobbying spectrum are different and more subtle. In the case of shallow integration, there was a clear-cut cleavage between import-competing interests and export interests. In this case, each lobby would like a loosening of its domestic regulations and a tightening of regulations in all foreign countries. In this environment, we show that a deep agreement increases welfare if lobbying pressures are either sufficiently small or sufficiently large, and can decrease welfare only for an intermediate range of lobbying pressures.

We then extend the model to analyze how the above conclusions are affected by the presence of ownership linkages across countries. In particular, we allow citizens of each

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[5]We are not the first ones to formalize the intuition that, in the context of a shallow agreement, tariff cuts may be affected by exporters' lobbying absent export subsidies. Other papers that make this point are Levy (1999), Ludema and Mayda (2016), Nicita et al (2018), and Lazarevski (2018). These are all two-country models and do not perform welfare analysis. We consider a model with many importers and many exporters, which among other things highlights the international externalities that tariffs exert on other importers, not just on exporters; and we perform welfare analysis.

[6]One such rule is a "market access preservation" rule that prevents countries from rolling back their market-access commitments by changing domestic policies. Bagwell and Staiger (2001) argue that GATT's "non-violation" clause performs this market-access-preservation function.

country to own shares of specific factors in any other countries. These ownership linkages can be interpreted as being brought about by foreign direct investment (FDI). We find sharp welfare results if countries are sufficiently close to symmetric: the presence of international ownership linkages reduces the welfare gains from shallow agreements, and makes it more likely that a deep agreement on process standards is bad for you, at least if lobbying pressures are strong enough. The reason is that ownership linkages impact cooperative policies only to the extent that political-influence parameters are heterogeneous across countries, while they reduce the distortions in non-cooperative policies.[7] On the other hand, we find that ownership linkages have little impact on the welfare effects of deep agreements on product standards; the basic reason is that non-cooperative product standards are not affected by lobbying at all (as mentioned above), and hence are not affected by ownership shares.

The rest of the paper is organized as follows. For expositional clarity, we start by analyzing a sequence of three simple models, and then we combine them in one integrated model. In particular, in Section 2 we consider a model of shallow integration with only import tariffs; in Section 3 we develop a model of deep integration where governments choose product standards to address consumption externalities; in Section 4 we examine deep integration in a model where governments choose production regulations to address production externalities; in Section 5 we take a detour and examine how foreign ownership affects the conclusions of the previous sections; in Section 6 we consider an integrated model that allows for consumption and production externalities, as well as all policy instruments. Section 7 concludes.

2 Shallow integration

2.1 Setup

We start with a variation of Grossman and Helpman's (1995a) "trade wars and trade talks" model, which differs from the original formulation in three ways: (1) We consider a continuum of small countries rather than two large countries, (2) we assume that countries only have access to import tariffs and not export subsidies, and (3) we model the influence of lobbies on trade policy choices in a slightly more flexible way. We focus only on shallow integration in this section and will introduce behind-the-border policies later on.

We consider a perfectly competitive world with a continuum of countries and $\mathcal{G}+1$ goods.

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[7]The result that international ownership linkages reduce non-cooperative tariffs is reminiscent of a similar point made in Blanchard (2010) and Blanchard, Bown and Johnson (2018).

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Good 0 is the numeraire. The representative consumer in country i has the following quasi-linear preferences

$$U_i = c_{i0} + \sum_{g \in \mathcal{G}} u_{ig}(c_{ig}), \tag{1}$$

where c_{i0} denotes country i's consumption of the numeraire good, c_{ig} denotes country i's consumption of good g, and $u_{ig}(\cdot)$ satisfies the usual properties $u'_{ig}(\cdot) > 0$ and $u''_{ig}(\cdot) < 0$. Utility maximization implies $p_{ig} = u'_{ig}(c_{ig})$, which can be inverted to yield the demand function $c_{ig} = d_{ig}(p_{ig})$, where p_{ig} is the price of good g in country i. The indirect utility of country i with income Y_i is then given by $V_i = Y_i + \sum_{g \in \mathcal{G}} S_{ig}(p_{ig})$, where $S_g(p_{ig}) \equiv u_{ig}(d_g(p_{ig})) - p_{ig}d_{ig}(p_{ig})$ is consumer surplus.

We assume that in each country the labor supply is large enough that there is positive production of the numeraire good in equilibrium. There are no trade costs other than the tariffs governments impose. Here and throughout, we normalize the mass of countries to one.

The numeraire good is produced one-for-one from labor, so the wage is equal to one everywhere. Each non-numeraire good is produced from labor and a sector-specific input whose returns in country i we denote by π_{ig}. Hotelling's lemma implies that $y_{ig}(p_{ig}) = \pi'_{ig}(p_{ig})$, where y_{ig} is country i's supply of good g.

Countries can impose specific tariffs τ_{ig} on goods that they import and do not have access to export policy instruments.[8] We denote the subset of countries which import good g by $\mathcal{M}_g$ and the complementary subset of countries which export good g by $\mathcal{X}_g$. Since tariffs drive a wedge between local prices and world prices and there are no export policy instruments, local prices satisfy $p_{ig} = p_g + \tau_{ig}$ for all $i \in \mathcal{M}_g$ and $p_{ig} = p_g$ for all $i \in \mathcal{X}_g$, where p_g is the world price of good g.

World prices are pinned down by world market clearing. Letting $m_{ig}(p_{ig}) = d_{ig}(p_{ig}) - y_{ig}(p_{ig})$ and $x_{ig}(p_{ig}) = y_{ig}(p_{ig}) - d_{ig}(p_{ig})$, we can express the world market clearing conditions as

$$\int_{i \in \mathcal{M}_g} m_{ig}(p_g + \tau_{ig}) = \int_{i \in \mathcal{X}_g} x_{ig}(p_g). \tag{2}$$

Total income in country i consists of labor income L_i, producer surplus $\sum_{g \in \mathcal{G}} \pi_{ig}$, and tariff revenue $\sum_{g \in \mathcal{G}} R_{ig}$ so that indirect utility can be rewritten as $V_i = L_i + \sum_{g \in \mathcal{G}}(\pi_{ig} + S_{ig} + R_{ig})$. Given that wages are normalized to 1 and the size of the labor force is assumed constant, we

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[8]We implicitly assume that countries set non-discriminatory (MFN) tariffs, but this is without loss of generality. Countries would not want to discriminate across origins anyway given that they are small relative to the world economy. We could allow for export taxes - what really matters is that countries do not have access to export subsidies.

can abstract from the first term in our welfare calculations and simply define welfare as the familiar sum of producer surplus, consumer surplus, and tariff revenue:

$$W_i = \sum_{g \in \mathcal{G}} W_{ig} = \sum_{g \in \mathcal{G}} \left(\pi_{ig} + S_{ig} + R_{ig} \right). \tag{3}$$

Governments are subject to lobbying pressures, so their objective function does not coincide with welfare. In the same spirit as Grossman and Helpman (1994, 1995), we assume lobbies represent the groups of specific-factor owners, and we capture the influence that lobbies have on the government by assuming that government i attaches extra weights γ_{ig} to the producer surplus in the various sectors.[9] Thus government i maximizes:

$$\Omega_i = \sum_{g \in \mathcal{G}} \Omega_{ig} = \sum_{g \in \mathcal{G}} \left[\left(1 + \gamma_{ig} \right) \pi_{ig} + S_{ig} + R_{ig} \right]. \tag{4}$$

A remark is in order on the difference between our "positive" government objective (4) and our "normative" criterion (3). We have adopted a utilitarian definition of welfare (just as in the Grossman-Helpman model) because it is the simplest and most natural one in this transferrable-utility environment, but we have in mind a broader interpretation: if we assigned different Pareto weights to different groups in our welfare criterion, our government objective would reflect these welfare weights plus the "bias" γ_{ig} introduced by lobbying. What really matters for our results is that producers get more weight in the government objective than in the welfare criterion.

We will compare a non-cooperative with a cooperative policy regime. In the non-cooperative regime, each country unilaterally sets tariffs to maximize Ω_i taking world prices and all other countries' tariffs as given. In the cooperative regime, countries jointly set tariffs to maximize their joint payoff $\Omega = \int_i \Omega_i$, taking the effect of tariffs on world prices into account. This implicitly assumes that countries have access to international transfers (in terms of the numeraire good).

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[9]This formulation of a government's objective is similar as in Baldwin (1987), and can be viewed as a reduced-form but slightly more flexible version of the government objectives in Grossman and Helpman (1995). In the latter model, $\gamma_{ig} = \frac{I_{ig} - \alpha_i^L}{a_i - \alpha_i^L}$, where I_{ig} is a dummy that is equal to one if industry i is politically organized, α_i^L is the share of the population represented by some lobby, and a_i is government i's valuation of welfare relative to campaign contributions. Also note that this model of lobbying implicitly assumes that labor-owners or consumers at large are not able to get politically organized, since these are large and dispersed economy-wide groups, so it is more difficult for them to overcome collective action problemss.

2.2 Non-cooperative equilibrium

In the non-cooperative equilibrium (NE), importing countries unilaterally set tariffs to maximize $\Omega_i = \sum_{g \in \mathcal{G}} \Omega_{ig}$. Since each country is small relative to the rest of the world, it takes world prices as given. This problem is separable across goods, so we can focus on a single good g:

$$\max_{\tau_{ig}} \Omega_{ig} = \left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g + \tau_{ig}\right) + S_{ig} \left(p_g + \tau_{ig}\right) + \tau_{ig} m_{ig} \left(p_g + \tau_{ig}\right), \quad i \in \mathcal{M}_g$$

We assume that Ω_{ig} is concave in τ_{ig} for all i. The first-order condition for country $i \in \mathcal{M}_g$ yields

$$\gamma_{ig} y_{ig} \left(p_g + \tau_{ig}\right) + \tau_{ig} m'_{ig} \left(p_g + \tau_{ig}\right) = 0,$$

where we used the facts that $\pi'_{ig} = y_{ig}$ and $S'_{ig} = -d_{ig}$. Thus the NE tariffs and world price for good g satisfy:

$$\tau^N_{ig} = \frac{\gamma_{ig} y_{ig}}{-m'_{ig}}, \quad i \in \mathcal{M}_g \text{ and} \tag{5}$$

$$\int_{i \in \mathcal{M}_g} m_{ig} = \int_{i \in \mathcal{X}_g} x_{ig}$$

Notice that $\tau^N_{ig} = 0$ if $\gamma_{ig} = 0$, so lobbying is the only reason why the NE policies deviate from free trade. Intuitively, countries use import tariffs to raise domestic prices and benefit producers in import-competing industries. Importantly, exporter interests are not taken into account in the NE tariffs, since countries cannot unilaterally affect domestic prices in their exporting industries.

2.3 Cooperative tariffs

As mentioned above, the trade agreement sets tariffs to maximize the governments' joint payoff $\Omega = \int_i \Omega_i = \sum_{g \in \mathcal{G}} \int_i \Omega_{ig}$. While an individual country cannot affect world prices, when countries act collectively they can affect world prices, so they choose tariffs taking into account their impact on world prices.

This problem is again separable across industries, so it suffices to maximize Ω_g:

$$\max_{\{\tau_{ig}\}_{i \in \mathcal{M}_g}, p_g} \Omega_g = \int_i \left[\left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g + \tau_{ig}\right) + S_{ig} \left(p_g + \tau_{ig}\right) + \tau_{ig} m_{ig} \left(p_g + \tau_{ig}\right)\right]$$

$$\text{s.t.} \int_{i \in \mathcal{M}_g} m_{ig} \left(p_g + \tau_{ig}\right) = \int_{i \in \mathcal{X}_g} x_{ig} \left(p_g\right),$$

where we keep in mind that $\tau_{ig} = 0$ for $i \in \mathcal{X}_g$ in the expression above.

Letting $p_g(\boldsymbol{\tau}_g)$ denote the market-clearing price given the tariffs (it is easy to show that this function is well-defined), we assume that $\Omega_g(\boldsymbol{\tau}_g, p_g(\boldsymbol{\tau}_g))$ is concave in $\boldsymbol{\tau}_g$. Denoting the lagrangian multiplier with λ_g, the first-order conditions can be written as

$$\gamma_{ig} y_{ig} + \tau_{ig} m'_{ig} + \lambda_g m'_{ig} = 0, \quad i \in \mathcal{M}_g$$

$$\int_{i \in \mathcal{M}_g} \left(\gamma_{ig} y_{ig} + \tau_{ig} m'_{ig} + \lambda_g m'_{ig} \right) + \int_{i \in \mathcal{X}_g} \left(\gamma_{ig} y_{ig} - \lambda_g x'_{ig} \right) = 0$$

Solving for λ_g and plugging into the first condition, we find that the cooperative tariffs and world price for good g satisfy:

$$\tau_{ig}^A = \frac{\gamma_{ig} y_{ig}}{-m'_{ig}} - \frac{\int_{i \in \mathcal{X}_g} \gamma_{ig} y_{ig}}{\int_{i \in \mathcal{X}_g} x'_{ig}}, \quad i \in \mathcal{M}_g \tag{6}$$

$$\int_{i \in \mathcal{M}_g} m_{ig} = \int_{i \in \mathcal{X}_g} x_{ig}$$

The key difference between the non-cooperative and the cooperative tariffs is the presence of the multiplier $\lambda_g = \frac{\int_{i \in \mathcal{X}_g} \gamma_{ig} y_{ig}}{\int_{i \in \mathcal{X}_g} x'_{ig}} > 0$ in equation (6). Notice that the numerator of λ_g captures the joint political power of exporters, since it integrates over all countries that are exporters of good g. This captures the intuition that exporter interests are taken into account in the cooperative equilibrium since countries can jointly increase world prices through tariff cuts.

2.4 What does the agreement do?

As we establish formally in the appendix, the trade agreement reduces all tariffs. Notice that this does not follow immediately from a comparison of equations (5) and (6) since they are evaluated at different world prices. Intuitively, non-cooperative tariffs reflect only the interests of import-competing producers while cooperative tariffs also reflect the interests of export-oriented ones. And exporters lobby for trade liberalization in the cooperative equilibrium since they benefit from an increase in the world price.

A deeper intuition for this result can be developed by considering the externality that a country's unilateral tariff exerts on other countries through the world price. Suppose a positive measure of importing countries increases their tariffs; this pushes down the world price by reducing import demand. How does this affect all other countries in the aggregate? Differentiating the joint payoff Ω_g with respect to the world price and evaluating at the NE tariffs, we find:

$$\frac{\partial \Omega_g}{\partial p_g} = -\int_{j \in \mathcal{M}_g} m_{ig} + \int_{j \in \mathcal{X}_g} \left(\gamma_{jg} y_{jg} + x_{ig}\right) = \int_{j \in \mathcal{X}_g} \gamma_{jg} y_{jg} \tag{7}$$

The first term indicates that the externality of tariff increases on other importers is positive, since a fall in the world price is an improvement in all importers' terms-of-trade. The second term shows that the externality on exporters is negative, for two reasons: it decreases the political surplus for all exporters, and it worsens their terms-of-trade. But the importers' aggregate terms-of-trade gain equal the exporters' aggregate terms-of-trade loss, so only the political externality $\int_{j \in \mathcal{X}_g} \gamma_{jg} y_{jg}$ remains. It is this externality that the trade agreement internalizes, as reflected in formula (6). Note that the net aggregate world-price externality does not include the loss of political surplus for importers ($\int_{j \in \mathcal{M}_g} \gamma_{jg} y_{jg}$), and the reason is that importers use tariffs optimally to benefit their domestic producers, whereas exporters lack policy instruments to do so.

While in our setting the purpose of a trade agreement is to deal with terms-of-trade externalities, there is a fundamental difference between the purpose of a trade agreement in our model and in the standard terms-of-trade theory. In our model, the purpose of a trade agreement is not to prevent individual countries from manipulating terms-of-trade, because individual countries use tariffs only for political reasons, not to manipulate terms-of-trade. Rather, a trade agreement is needed because of lobbying pressures *and* the fact that exporting countries cannot use export subsidies to help their producers. Indeed, it is easy to show that the world price externality (7) would be zero at the NE if countries also had access to export subsidies, and as a result NE tariffs would be efficient, so there would be no scope for trade negotiations. And it is also apparent from (7) that there would be no need for an agreement if governments were welfare-maximizers.

We record the result above in the following proposition. The proof of this and all other results are in the Appendix.

Proposition 1 *The equilibrium trade agreement lowers all import tariffs relative to non-cooperative levels. The extent of tariff liberalization is increasing in the aggregate political power of exporters.*

The main intuition underlying this result is that the trade agreement empowers exporter interests, which then become a counterbalance to import-competing interests and thus dilute the overall effect of lobbying on trade policy.

Our model captures an often-heard "story" about the success of GATT/WTO negotiations that is quite different from the standard terms-of-trade theory: tariffs fell because the GATT/WTO changed the political calculus of policy makers, and welfare rose because lobbying pressures from exporter groups countered the interests of import-competing groups. The standard terms-of-trade story, on the other hand, is that tariffs fell because the agreement removed the individual countries' incentives to manipulate terms of trade. Note that in our model individual countries are small, so they have no ability to manipulate terms of trade.

2.5   Is it good for you?

Given that all tariffs fall as a result of the trade agreement, one might conjecture that it has positive welfare effects. This is not immediately obvious because we are allowing countries to be asymmetric in a number of dimensions, and we know from second-best theory that partial reductions of distortions (wedges) do not necessarily increase welfare. But we do confirm this conjecture (under our assumption that government payoffs are concave), subject to the caveat that the agreement must not entail large import subsidies. We record this point with:

Proposition 2 *The equilibrium trade agreement improves global welfare relative to the non-cooperative equilibrium, provided the agreement does not entail large import subsidies.*

3   Deep integration: Product standards

3.1   Setup

We now turn to an analysis of deep integration, focusing first on consumption-side policies. Our main focus is on product standards, a common behind-the-border policy that features prominently in recent trade agreements. Product standards impose restrictions on the characteristics of products sold in the local market. Examples include emissions standards for automobiles, safety standards for children's toys, or health standards for meat products.

We modify the model in two ways. First, to introduce a role for product standards, we now assume that each good comes in a continuum of varieties, indexed by their 'dirtiness' $e_g \in [0, \infty)$. Second, to provide a welfare rationale for product standards we allow for local consumption externalities. For concreteness, we will focus on local environmental externalities. In country i, consumption of variety e_{ig} generates local emissions $e_{ig}d_{ig}$ (e.g. emissions of pollutants from cars), which in turn generate a negative local externality $-a_{ig}e_{ig}d_{ig}$.

Producers have to incur an abatement cost $1/e_{ig}$ in terms of the outside good in order to produce variety e_{ig}.[10] Varieties are indistinguishable in the eyes of consumers, so they do not value directly the cleanliness of a product.

Each government i chooses emission standards e_{ig} for products sold in its own market. These can be interpreted as emission *caps*, because a cap is always binding, since producing cleaner products is costly and consumers do not value cleanliness directly.

Due to arbitrage, the price faced by consumers is $p_g + \frac{1}{e_{ig}}$, while the producer price net of abatement costs is p_g.

To make our points as clearly as possible, we set tariffs equal to zero for now.

Note that a product standard is a second-best policy, because given the variety e_{ig} selected by the government consumers do not internalize the consumption externality. It is easy to argue that the first best can be implemented with a product standard combined with a consumption tax. At the end of this section we will argue that if both instruments were available our conclusions would get strengthened.

3.2 Non-cooperative equilibrium

In the non-cooperative scenario, each government i solves:

$$\max_{e_{ig}} \Omega_{ig} = \left(1 + \gamma_{ig}\right) \pi_{ig}\left(p_g\right) + S_{ig}\left(p_g + \frac{1}{e_{ig}}\right) - a_{ig}e_{ig}d_{ig}\left(p_g + \frac{1}{e_{ig}}\right),$$

The first-order conditions can be written as $-e_{ig}^2 - \sigma_{ig}e_{ig} + \frac{1}{a_{ig}} = 0$, where $\sigma_{ig} = -\frac{d'_{ig}}{d_{ig}} > 0$ denotes the demand semi-elasticity.[11] The non-cooperative equilibrium product standards and world price for good g jointly solve the above FOCs and the market-clearing condition:

$$e_{ig}^N = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}} \quad \text{for all } i, \tag{8}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

Notice that the lobbying parameters γ_{ig} do not affect NE product standards. The reason is that a small country cannot affect the producer price p_g with a product standard, so this instrument cannot be used to help domestic producers. Notice also that NE standards are tighter (e_{ig}^N falls) when externalities are stronger (a_{ig} larger), as one would expect.

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[10]Notice that this implies convex abatement costs. Our results extend to a more general convex abatement cost function.

[11]Note that $\frac{\partial \Omega_{ig}}{\partial e_{ig}}$ evaluated at $e_{ig} = 0$ is positive, so unilateral standards are always interior.

3.3 Cooperative product standards

Cooperative product standards solve:

$$\max_{\{e_{ig}\},p_g} \Omega_g = \int_i \left[\left(1 + \gamma_{ig}\right) \pi_{ig}\left(p_g\right) + S_{ig}\left(p_g + \frac{1}{e_{ig}}\right) - a_{ig}e_{ig}d_{ig}\left(p_g + \frac{1}{e_{ig}}\right) \right] \tag{9}$$

$$\text{s.t.} \quad \int_i y_{ig}\left(p_g\right) = \int_i d_{ig}\left(p_g + \frac{1}{e_{ig}}\right)$$

We assume that $\Omega_g(\mathbf{e}_g, p_g(\mathbf{e}_g))$ is concave in $\mathbf{e}_g$, where $p_g(\mathbf{e}_g)$ denotes the market-clearing price given the standards. Denoting the lagrangian multiplier with λ_g, it is direct to verify that the cooperative standards and world price for good g satisfy:

$$e_{ig}^A = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}\left(1 + \lambda_g\sigma_{ig}\right)} \quad \text{for all } i \tag{10}$$

$$\lambda_g = \frac{\int_i \left(\gamma_{ig}y_{ig} + a_{ig}e_{ig}^A\sigma_{ig}d_{ig}\right)}{\int_i \left(\varepsilon_{ig}y_{ig} + \sigma_{ig}d_{ig}\right)} > 0$$

$$\int_i y_{ig} = \int_i d_{ig},$$

where $\varepsilon_{ig} \equiv \frac{y'_{ig}}{y_{ig}}$ denotes the semi-elasticity of supply. The main difference between the non-cooperative and the cooperative product standards is the presence of the multiplier λ_g in equation (10). Since $\lambda_g > 0$ even if $\gamma_{ig} = 0$, it is clear that the agreement changes standards for both political and environmental reasons, a finding that we explore more thoroughly below. For now, just notice that all producers have a common interest in loosening product standards, since they all benefit from the resulting increase in the world price.

3.4 What does the agreement do?

To understand how the agreement changes product standards relative to the non-cooperative equilibrium, we start with a local argument.

Let us consider the international externalities caused by a change in product standards starting from the non-cooperative equilibrium. Suppose a positive measure of countries loosens their standards; this pushes up the world price by boosting demand. How does this affect the joint payoff of all governments? Differentiating the joint government payoff Ω_g with respect to p_g and plugging in the expression for NE standards (8), we obtain:

$$\frac{\partial \Omega_g}{\partial p_g}\Big|_{NE} = \int_i \left(\gamma_{ig}y_{ig} + a_{ig}e_{ig}^N\sigma_{ig}d_{ig}\right) > 0 \tag{11}$$

The first term is positive and captures the beneficial effect of an increase in the world price for producers world-wide. This is similar to the political world-price externality discussed in the context of shallow integration, with the important difference that now all producers and not just exporters benefit. The second term is also positive and is due to the fact that an increase in the world price reduces consumption and thereby mitigates the local environmental externality in all countries.

Having established that the aggregate international externality from loosening standards at the NE is positive, it is easy to show that the *best local agreement* entails increasing e_{ig} for all countries, where the best local agreement is defined as the local change in product standards that achieves the steepest rate of improvement in the objective starting from NE standards.[12]

Does the local result shown above hold also globally, so that the optimal agreement loosens all product standards? As we show in the proof of the following proposition, one sufficient condition for this is that countries are sufficiently close to symmetric, and an alternative sufficient condition is that the demand semi-elasticities σ_{ig} do not vary too much with the local price. For simplicity, however, in what follows we simply assume that the objective function is sufficiently well behaved that the local result shown above holds also globally. Under this assumption, we can state:

Proposition 3 *Regardless of lobbying pressures, the agreement loosens all product standards. Furthermore, cooperative standards are looser when lobbying pressures are stronger.*

3.5 Is it good for you?

Recall from the discussion above that there are two motives from an agreement on product standards: one political and one environmental. Letting $\Delta \equiv W^A - W^N$ denote the (positive or negative) welfare change caused by the agreement relative to the non-cooperative equilibrium, the political motive pushes Δ down, since only the cooperative standards are distorted by lobbying pressures. Instead of the counter-lobbying we highlighted in the context of shallow integration, we now have co-lobbying of all producers world-wide, since they share a common interest in boosting the world price. The environmental motive, on the other

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[12]This follows from two observations: first, $\frac{\partial \Omega_g}{\partial p_g} > 0$ implies that $\Omega_g(\mathbf{e}_g, p_g(\mathbf{e}_g))$ is stricty increasing in each e_i when evaluated at the NE; and this in turn implies that the direction of steepest ascent of the objective Ω_g starting from the NE entails increasing all standards.

hand, pushes Δ up: intuitively, if lobbying pressures were absent the agreement would be motivated just by welfare considerations, and hence Δ would be positive.

Due to these counteracting forces, we need to impose more structure to obtain clean welfare results. A simple assumption that is sufficient for our purposes is that countries are sufficiently close to symmetric, so we will impose this assumption henceforth. Under this assumption, we can show that the agreement is good for you if political economy forces are weak but bad for you if political economy forces are strong, just as the above reasoning suggests.

We start by analyzing the case of full symmetry, and then we extend the results to the case of near-symmetry. Our argument for the case of full symmetry can be illustrated with the help of Figure 1.

Figure 1: Product Standards
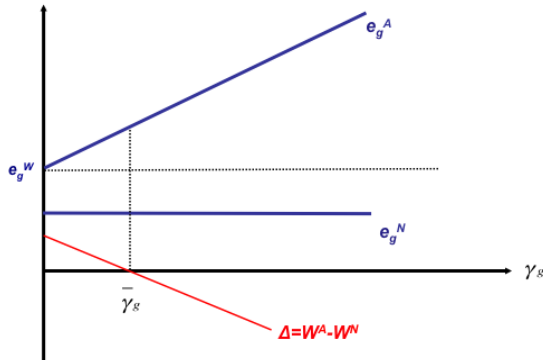
Here we explain Figure 1 intuitively; the formal arguments can be found in the proof of Proposition 4. This figure draws the NE standards e_g^N and the cooperative standards e_g^A as functions of the political economy parameter γ_g. It also shows the welfare-maximizing standards e_g^W and the welfare gain from the agreement, $\Delta = W^A - W^N$. As should be clear from our earlier analysis, the NE standards do not depend on γ_g and are tighter than the welfare-maximizing standards $(e_g^N < e_g^W)$.[13] The e_g^A schedule coincides with e_g^W for $\gamma_g = 0$ and is increasing in γ_g; this is because stronger lobbying pressures lead to looser standards, since producers benefit from a rise in the world price. The welfare gain from the agreement

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[13]Recall that loosening standards increases the world price, which in turn mitigates the local consumption externality world-wide.

(Δ) is of course positive at $\gamma_g = 0$, but is decreasing in γ_g and at some point it turns negative. Intuitively, cooperative standards get looser and looser, and at some point the implied welfare distortion exceeds the welfare distortion associated with the excessively-tight NE standards.

A continuity argument allows us to extend the result described above to the case in which countries are close to symmetric.[14] To state the extended result, we consider a proportional change in all political parameters γ_{ig}. Formally, we define $\gamma_{ig} = \gamma_g \cdot \nu_{ig}$ and vary the scaling parameter γ_g. We can state:

Proposition 4 *If countries are not too asymmetric, cooperation on product standards is good for you if γ_g is below a critical level $\bar{\gamma}_g$ and bad for you if γ_g is above $\bar{\gamma}_g$.*

Before proceeding, we return to the question raised earlier of how results change if consumption taxes are available. As mentioned earlier, the first best can be implemented with a product standard and a consumption tax. In particular, it is easy to see that the first best variety is $e_{ig} = \frac{1}{\sqrt{a_{ig}}}$ and the first best consumption tax is $t_{ig} = \sqrt{a_{ig}}$.[15] A key point is that these policies maximize not only global welfare, but also unilateral welfare, thus they are the non-cooperative equilibrium policies. It is then an immediate corollary that the cooperative policies decrease welfare relative to the NE policies. In particular, the cooperative policies can be shown to be $t_{ig}^A = \sqrt{a_{ig}} - \frac{\int_j \gamma_{jg} y_{jg}}{\int_j \varepsilon_{ig} y_{jg}}$, $e_{ig}^A = \frac{1}{\sqrt{a_{ig}}}$. Thus the availability of consumption taxes makes the conclusion more pessimistic: a deep agreement on product standards in this case is bad for you regardless of lobbying pressures, and the welfare loss is bigger the stringer are lobbying pressures.

4 Deep integration: Process standards

4.1 Setup

We now turn to production regulations, which differ from product standards in important ways. We will use interchangeably the expressions "production regulations" and "process standards" to mean policies that restrict the production process on domestic soil. Examples

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[14]Given the assumption that the objective function is concave, and noting that it is smooth in the standards and in the exogenous parameters, it follows that the optimal cooperative standards are continuous in the exogenous parameters.

[15]One way to show that these policies implement the first best is to note that they are equivalent to the Pigouvian emission-contingent tax $t_{ig}(e_{ig}) = a_{ig} e_{ig}$. To see this equivalence, note that given the Pigouvian tax schedule, consumers will buy only the variety with the minimum consumer price, and this is easily calculated to be $e_{ig} = \frac{1}{\sqrt{a_{ig}}}$. And conditional on this variety, the Pigouvian single-rate consumption tax is $t_{ig} = \sqrt{a_{ig}}$.

include environmental regulations for factories, safety standards for workers or health standards for farm animals. To provide a welfare rationale for process standards, we will allow for local production externalities. For concreteness we will focus on pollution externalities, but a broader interpretation should be kept in mind.

To simplify our analysis, in this section we focus on a world with only production externalities and process standards. We will later consider an integrated model which encompasses this and he previous two models.

We assume that each good g can be produced with a continuum of technologies $z_g \in [0, \infty)$, indexed by their 'dirtiness.' In country i, use of technology z_{ig} generates local pollution $z_{ig}y_{ig}$, which in turn generates a negative local externality $-b_{ig}z_gy_{ig}$. Producers have to incur an abatement cost $1/z_{ig}$ in terms of the outside good in order to use technology z_g. Otherwise, all technologies are identical.

Each government chooses process standards z_{ig} for firms operating on its domestic soil. These can be interpreted as pollution caps, because caps are always binding, since adopting cleaner technologies is costly and does not directly benefit producers.

Due to arbitrage, the consumer price is p_g and the producer price net of abatement costs is $p_g - \frac{1}{z_{ig}}$.

Similarly as for product standards, process standards are second-best policies, because given the technology z_{ig} selected by the government, producers do not internalize the production externality. The first best can be implemented with a combination of process standards and production taxes. At the end of this section we will discuss how the availability of production taxes would change our conclusions.

4.2 Non-cooperative equilibrium

Non-cooperative process standards can be found by solving:

$$\max_{z_{ig}} \Omega_{ig} = \left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g - \frac{1}{z_{ig}}\right) + S_{ig}\left(p_g\right) - b_{ig}z_{ig}y_{ig}\left(p_g - \frac{1}{z_{ig}}\right) \tag{12}$$

The first-order condition for this problem can be written as $-b_{ig}z_{ig}^2 - b_{ig}\varepsilon_{ig}z_{ig} + 1 + \gamma_{ig} = 0$. The non-cooperative equilibrium process standards and world price for good g jointly solve the above FOCs and the market-clearing condition:

$$z_{ig}^N = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1}{b_{ig}}(1 + \gamma_{ig})} \quad \text{for all } i, \tag{13}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

Unlike product standards, unilateral process standards *are* influenced by lobbies. The reason is that process standards directly affect producer prices, so producer lobbies have an incentive to get involved.

Note from (13) that increasing lobbying pressures in country i (increasing γ_{ig}) holding all else equal leads to a looser unilateral standard z_{ig}^N. If we increase all political parameters at the same time, however, the world price will be affected, and this may in turn affect the supply elasticity ε_{ig} (which in general depends on the price). To ensure that a general increase in lobbying pressures has the intuitive effect of loosening NE standards, we assume henceforth that ε_{ig} does not vary too much with the price.

Notice also that NE standards are tighter (z_{ig}^N is lower) when production externalities are more important (b_{ig} is higher), as one would expect.

4.3   Cooperative process standards

The cooperative process standards can be found by solving:

$$\max_{\{z_{ig}\},p_g} \Omega_g = \int_i \left[(1 + \gamma_{ig}) \pi_{ig} \left(p_g - \frac{1}{z_{ig}} \right) + S_{ig}(p_g) - b_{ig} z_{ig} y_{ig} \left(p_g - \frac{1}{z_{ig}} \right) \right] \qquad (14)$$

$$\text{s.t.} \quad \int_i y_{ig} \left(p_g - \frac{1}{z_{ig}} \right) = \int_i d_{ig}(p_g)$$

We assume that $\Omega_g(\mathbf{z}_g, p_g(\mathbf{z}_g))$ is concave in $\mathbf{z}_g$, where $p_g(\mathbf{z}_g)$ denotes the market-clearing price given the standards. Denoting the lagrangian multiplier with λ_g, it is direct to verify that the cooperative standards and world price for good g satisfy:

$$z_{ig}^A = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2} \right)^2 + \frac{1}{b_{ig}} \left(1 + \gamma_{ig} - \lambda_g \varepsilon_{ig} \right)} \quad \text{for all } i \qquad (15)$$

$$\lambda_g = \frac{\int_i y_{ig} \left(\gamma_{ig} - b_{ig} z_{ig}^A \varepsilon_{ig} \right)}{\int_i \varepsilon_{ig} y_{ig} + \int_i \sigma_{ig} d_{ig}}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

The main difference between the non-cooperative and the cooperative process standards is the presence of the multiplier λ_g in equation (15). The agreement again changes standards for political and environmental reasons, but these two forces now enter with opposite signs. In

particular, $\lambda_g \lesseqgtr 0$ as $\gamma_{ig} \lesseqgtr b_{ig} z_{ig}^A \varepsilon_{ig}$. This suggests that the agreement will loosen standards when lobbying pressures are weak and tighten standards when lobbying pressures are strong. We next probe this intuition.

4.4   What does the agreement do?

To examine how the agreement changes process standards, we start again with a local argument. Consider the international externalities caused by a change in process standards starting from the non-cooperative equilibrium. Suppose a positive measure of countries loosens their standards; this boosts supply and hence pushes down the world price. How does this affect the joint payoff of all governments? Differentiating the joint government payoff Ω_g with respect to p_g and evaluating at the NE standards (8), we obtain:

$$\frac{\partial \Omega_g}{\partial p_g}|_{NE} = \int_i y_{ig} \left(\gamma_{ig} - b_{ig} z_{ig}^N \varepsilon_{ig} \right)$$

The first term is the positive political externality caused by a higher world price. The second term reflects is negative and is due to the fact that a higher world price stimulates supply, thus increasing pollution world-wide.

As in the previous section, we consider a proportional change in all political parameters, by defining $\gamma_{ig} = \gamma_g \cdot \nu_{ig}$ and varying the scaling parameter γ_g. In appendix we show that there exists a critical value $\hat{\gamma}_g$ such that $\frac{\partial \Omega_g}{\partial p_g}|_{NE} > 0$ if $\gamma_g > \hat{\gamma}_g$ and $\frac{\partial \Omega_g}{\partial p_g}|_{NE} < 0$ if $\gamma_g < \hat{\gamma}_g$. It then follows, using a similar logic as earlier, that the best local agreement tightens all standards if $\gamma_g > \hat{\gamma}_g$ and loosens all standards if $\gamma_g < \hat{\gamma}_g$.

Assuming that the objective function is sufficiently well behaved that the local result highlighted above holds globally, we can then state:

Proposition 5 *The agreement loosens all process standards if $\gamma_g < \hat{\gamma}_g$ and it tightens all process standards if $\gamma_g > \hat{\gamma}_g$.*

4.5   Is it good for you?

In order to obtain clean welfare results, we again assume that countries are sufficiently close to symmetric. Under this assumption, we will show that the welfare effect of the trade agreement is non-monotonic in γ_g, and in particular, it is first good for you, then bad for you, and then again good for you. For our purposes, the most interesting part of this result is that the agreement is welfare improving for high γ_g, since this is the opposite of what we

found in the case of product standards above. The fundamental reason for this difference is that the interests of producers around the world are no longer aligned when it comes to production regulations, since each producer lobby prefers weak regulations at home and strict regulations abroad. As a result, the deep agreement now brings about counter-lobbying, thereby diluting the overall effect of lobbies on process standards. Notice how the nature of counter-lobbying here differs from the case of shallow integration: there, the cleavage was between import-competing interests and export interests.

We now explain the logic behind our result. As in the previous section, we start by focusing on the case of full symmetry and then we extend the results to the case of near-symmetry. Our argument for the case of full symmetry can be illustrated intuitively with the help of Figure 2.

Figure 2: Process Standards
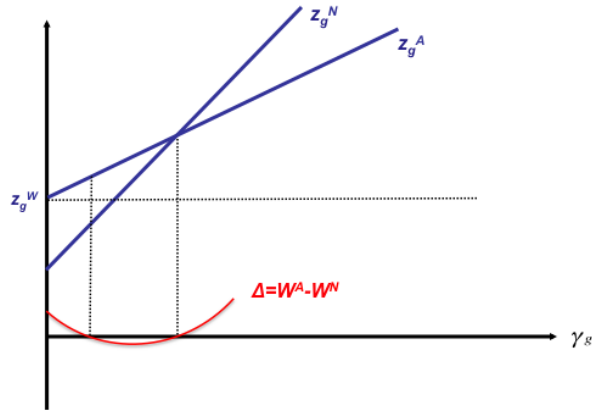
This figure shows the NE standards z_g^N, the cooperative standards z_g^A and the welfare maximizing standards z_g^W as functions of γ_g, as well as the welfare change from the agreement, $\Delta = W^A - W^N$.

Absent lobbying pressures ($\gamma_g = 0$), the NE standards are stricter than the welfare maximizing standards ($z_g^N < z_g^A$), since governments do not internalize the negative environmental externality caused by tighening standards through the world price. As γ_g increases, NE standards become looser, since each government attaches higher value to local producers, and unilaterally loosening its standard benefits them. The z_g^A schedule starts at the welfare

maximizing standards and is also increasing in γ_g (as can be easily shown). However, this is flatter than the z_g^N schedule, since governments internalize the negative political terms-of-trade externality from loosening standards, and such externality becomes stronger as γ_g increases. This captures the counter-lobbying intuition we mentioned earlier: looser domestic standards harm the interests of producers abroad, thus cooperation moderates the loosening of standards that is brought about by increases in lobbying pressures.

The welfare change from the agreement (Δ) is of course positive at $\gamma_g = 0$, and it must be positive again for γ_g large enough; the latter statement follows from the facts that if γ_g is large enough then $z_g^N > z_g^A > z_g^W$, and that welfare is concave in the standards.[16] Finally note that Δ must be negative for some γ_g, since the NE standards coincide with the welfare maximizing standards for some value of γ_g.

We summarize these normative results with:

Proposition 6 *If countries are not too asymmetric, cooperation on process standards increases welfare if γ is sufficiently low or sufficiently high, and decreases welfare for some intermediate interval of γ.*

Before proceeding, we briefly discuss how results would change if production taxes were available. Clearly, if production subsidies were available, our model would not have legs to stand on, as virtually any other political economy model. But one could consider a world where production taxes are restricted to be non-negative. In an earlier version of this paper we have considered this case, and showed that non-cooperative production taxes would be set at their Pigouvian levels minus a tax cut that is increasing in the political power of domestic producers. If the non-negativity constraint is not binding for any country, these tax cuts replicate the effects of production subsidies, and there is no scope for a deep agreement. But if the non-negativity constraint is binding for a subset of countries there will be scope for an agreement, and under some conditions the equilibrium agreement would increase welfare. Intuitively, the agreement would allow constrained countries to obtain "help" for their producers, by getting unconstrained countries to increase their taxes in order to push up world prices. The agreement in this case would tend to increase welfare because non-cooperative taxes are too low due to lobbying pressures.

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[16]We assumed that the joint payoff Ω_g is concave in $\mathbf{z}_g$, thus also welfare is concave, since it coincides with Ω_g for $\gamma_g = 0$.

5 International ownership linkages

So far we have assumed that all production factors are fully owned by domestic residents, an assumption that is increasingly violated in today's economy. We now explore the effects of introducing international ownership linkages, brought about for example by FDI. In particular, we now assume that country i owns a share θ_{ijg} of the good-g specific factor in country j. As a result, a share θ_{ijg} of country j's producer surplus accrues to citizens of country i, and we denote the corresponding value by $\pi_{ijg} \equiv \theta_{ijg}\pi_{jg}$. Note that the derivative of π_{ijg} with respect to the local producer price in country j is given by $\theta_{ijg}y_{jg} \equiv y_{ijg}$. To simplify the analysis, we assume constant demand and supply semi-elasticities throughout this section.

In what follows we revisit our main conclusions in a heuristic way, relegating the complete proofs to the appendix.

It is useful to preview two key implications of international ownership linkages. First, they reduce the influence of lobbies on unilateral policies (provided policies can affect domestic rents – which is the case for tariffs and process standards), because when choosing policies unilaterally, governments take into account only the share of domestic rents that accrue to domestic residents, and this share is smaller in the presence of foreign ownership. Second, ownership linkages affect cooperative policies only to the extent that political economy weights vary across countries; if these are the same across countries, only the aggregate rents for the whole world matter for cooperative policies, thus ownership shares do not matter.

Let us now revisit the welfare implications of shallow integration. It is easy to verify that our expressions for non-cooperative and cooperative tariffs now become

$$\tau_{ig}^N = \frac{y_{ig}\left[\gamma_{ig}\theta_{iig} - (1-\theta_{iig})\right]}{-m'_{ig}}, \quad i \in \mathcal{M}_g, \tag{16}$$

$$\tau_{ig}^A = \frac{y_{ig}\int_j \gamma_{jg}\theta_{jig}}{-m'_{ig}} - \frac{\int_{j\in\mathcal{X}_g}\left(\int_i \theta_{ijg}\gamma_{ig}\right)y_{jg}}{\int_{j\in\mathcal{X}_g} x'_{jg}}, \quad i \in \mathcal{M}_g. \tag{17}$$

As mentioned above, ownership linkages reduce the influence of lobbies on NE tariffs while essentially leaving the influence of lobbies on cooperative tariffs unchanged. First note that τ_{ig}^N is increasing in the domestic ownership share θ_{iig}.[17] Next note that our new formula for

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[17]This statement is valid if θ_{iig} changes for country i while holding all else equal. If the domestic ownership shares change for all countries at the same time, one needs to make a regularity assumption for the intuitive result to hold, because the world price changes in response to the change in ownership shares. Suppose countries are symmetric, except that importers have suppy y_g^m and exporters have supply y_g^x (this is the case we focus on below). The condition is that the elasticity of $\frac{y_g^m(p_g(\tau_g)+\tau_g)}{-m'_g(p_g(\tau_g)+\tau_g)}$ with respect to τ_g is less than one,

cooperative tariffs (17) differs from our old one (6) only if γ_{ig} differs across countries. In the non-cooperative equilibrium, governments now only care about the share θ_{iig} of producer surplus that accrues to domestic citizens. But in the cooperative equilibrium, governments care also about the share of producer surplus that accrues to foreign citizens, with the only modification that this component may now have different political economy weights. Overall, this suggests that foreign ownership tends to reduce the welfare gains from shallow agreements, a result we state more formally below.

Next focus on the welfare implications of deep agreements on product standards. It is immediate to verify that the expressions for non-cooperative and cooperative product standards now become

$$e_{ig}^N = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}}, \tag{18}$$

$$e_{ig}^A = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}\left(1 + \lambda_g \sigma_{ig}\right)}, \text{ where} \tag{19}$$

$$\lambda_g = \frac{\int_i \left(\int_j \gamma_{ig} y_{ijg} + a_{ig} e_{ig}^A \sigma_{ig} d_{ig}\right)}{\int_i \left(\varepsilon_{ig} y_{ig} + \sigma_{ig} d_{ig}\right)}.$$

The expressions above reveal that international ownership linkages have no impact on non-cooperative standards, and only a minor impact on cooperative standards. The only new feature is that the first term in the numerator of the multiplier is now $\int_i \int_j \gamma_{ig} y_{ijg}$ instead of $\int_i \gamma_{ig} y_{ig}$, a difference which would disappear if $\gamma_{ig} = \gamma_g$ for all i. Intuitively, NE product standards are not affected by lobbying at all, so it does not matter how producer surplus is shared. And cooperative standards reflect the interests of all producers, domestic and foreign, so they are affected by foreign ownership linkages only if political weights are heterogeneous across countries. This suggests that foreign ownership does not affect the qualitative welfare implications of such deep agreements, a result we state more formally below.

Finally, focus on the welfare effects of deep agreements on process standards. It is direct to verify that our expressions for the non-cooperative and cooperative process standards now become

$$z_{ig}^N = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{\theta_{iig}}{b_{ig}}\left(1 + \gamma_{ig}\right)}, \tag{20}$$

where $p_g(\tau_g)$ is the market clearing price given τ_g.

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$$z_{ig}^A = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1}{b_{ig}}\left[\theta_{iig}\left(1 + \gamma_{ig}\right) - \lambda_g \varepsilon_{ig}\right]}, \text{ where} \tag{21}$$

$$\lambda_g = \frac{\int_i \left(\int_j \gamma_{ig} y_{ijg} - b_{ig} z_{ig} \varepsilon_{ig} y_{ig}\right)}{\int_i \left(\varepsilon_{ig} y_{ig} + \sigma_{ig} d_{ig}\right)}.$$

Notice that NE standards are tighter when the domestic ownership share θ_{iig} is lower. The intuition is the same as in the shallow integration case: in the non-cooperative equilibrium, governments care less about domestically-generated producer surplus the more of it accrues to foreign residents. This is no longer the case in the cooperative equilibrium, where the interests of all countries' lobbies are taken into account. Notice that the first term in the numerator of the multiplier is now again $\int_i \int_j \gamma_{ig} y_{ijg}$ instead of $\int_i \gamma_{ig} y_{ig}$, a difference that disappears if $\gamma_{ig} = \gamma_g$ for all i.

To understand how ownership linkages change the welfare consequences of such deep agreements, it is useful to focus once again on the case of fully symmetric countries and revisit Figure 2.

Figure 3: Process Standards with Foreign Ownership
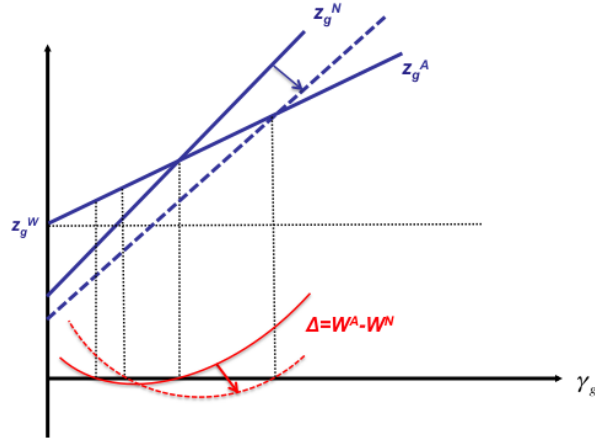
As should be clear from our discussion above, in this case the cooperative standard z_g^A is not affected by foreign ownership. Given our assumption of constant semi-elasticities, it is immediate to see from a comparison of equations (13) and (20) that a decrease in the domestic ownership share makes the z_g^N schedule flatter and shifts it down. As Figure 3 illustrates, when γ_g is large this reduces the welfare gains from the agreement, and increases

the threshold of γ_g above which the welfare gains are positive. Note also that when γ_g is below a certain threshold the opposite is true, and foreign ownership increases the welfare gains from the agreement.

The following proposition, proved in the appendix, summarizes the implications of foreign ownership for the welfare effects of shallow and deep integration:[18]

Proposition 7 *Suppose countries are not too asymmetric. Then international ownership linkages: (i) diminish the welfare gain from a shallow agreement, and can even make it negative; (ii) do not change the welfare implications of agreements on product standards; (iii) worsen the welfare implications of agreements on process standards if lobbying pressures are sufficiently strong and improves them if lobbying pressures are sufficiently weak.*

The overall message that emerges from this analysis is that, if one believes that lobbies have a strong influence on international agreements, the presence of international ownership linkages tends to worsen the welfare implications of such agreements.

6 Integrated Model

Thus far we have examined the welfare implications of international cooperation on tariffs, consumption-side regulations and production-side regulations with the aid of three separate models. We now consider an integrated model to explore the possible interactions between these policies, while at the same time allowing for both consumption and production externalities. To avoid overloading the algebra we return to the case of no foreign ownership, but it would be straightforward to add this.

The natural first step would be to examine a shallow integration scenario where governments negotiate over tariffs taking into account that in a second stage governments will choose standards unilaterally. This case turns out to be quite complex and is still work in progress. Here we focus only on deep integration, and in particular we consider two possible scenarios: (1) a scenario where tariffs have previously been eliminated, as for example in the EU (where customs have been completely removed), and the agreement focuses on product and process standards; (2) a scenario where tariffs are available, and governments negotiate a comprehensive agreement that covers tariffs, product standards and process standards. We start with the first scenario.

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[18]In the following proposition, for simplicity we assume that countries are close to symmetric, but for part (i) all we need is that importing countries are close to symmetric, and γ_{ig} and θ_{iig} are close to symmetric for all countries.

6.1 Regulatory cooperation in the absence of tariffs

We focus first on the case in which tariffs have been eliminated in previous negotiations, so that the agreement revolves only around product and process standards.

The economic structure simply merges the structures of sections 3 and 4, allowing for a continuum of varieties and a continuum of technologies, with the same respective abatement costs and externalities. Thus, local producer prices net of abatement costs are given by $p_g - \frac{1}{z_{ig}}$ and local consumer prices are given by $p_g + \frac{1}{e_{ig}}$.

6.1.1 Non-cooperative equilibrium

Government i solves:

$$\max_{\{e_{ig}, z_{ig}\}} \Omega_{ig} = \left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g - \frac{1}{z_{ig}}\right) + S_{ig} \left(p_g + \frac{1}{e_{ig}}\right) - a_{ig} e_{ig} d_{ig} \left(p_g + \frac{1}{e_{ig}}\right) - b_{ig} z_{ig} y_{ig} \left(p_g - \frac{1}{z_{ig}}\right).$$

Simple algebra reveals that the non-cooperative standards and world price for good g satisfy:

$$e_{ig}^N = \frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}} \text{ for all } i$$

$$z_{ig}^N = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1}{b_{ig}}\left(1 + \gamma_{ig}\right)}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

While these formulas are the same as in our earlier models, note that they are now evaluated at different prices, so the NE standards are not the same as before, unless the semi-elasticities are constant.

6.1.2 Cooperative standards

The cooperative standards can be found by solving:

$$\max_{\{e_{ig}, z_{ig}\}, p_g} \Omega_g = \int_i \{\left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g - \frac{1}{z_{ig}}\right) + S_{ig} \left(p_g + \frac{1}{e_{ig}}\right) - a_{ig} e_{ig} d_{ig} \left(p_g + \frac{1}{e_{ig}}\right) - b_{ig} z_{ig} y_{ig} \left(p_g - \frac{1}{z_{ig}}\right)$$

$$\text{s.t. } \int_i y_{ig} \left(p_g - \frac{1}{z_{ig}}\right) = \int_i d_{ig} \left(p_g + \frac{1}{e_{ig}}\right)$$

Assume $\Omega_g(\mathbf{e}_g, \mathbf{z}_g, p_g(\mathbf{e}_g, \mathbf{z}_g))$ is concave in $(\mathbf{e}_g, \mathbf{z}_g)$, where $p_g(\mathbf{e}_g, \mathbf{z}_g)$ is the market clearing price. Denoting the lagrangian multiplier by λ_g, it is easy to verify that the cooperative policies and world prices satisfy:

$$e_{ig}^A = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}}\left(1 + \sigma_{ig}\lambda_g\right)} \text{ for all } i$$

$$z_{ig}^A = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1}{b_{ig}}\left(1 + \gamma_{ig} - \varepsilon_{ig}\lambda_g\right)} \text{ for all } i$$

$$\lambda_g = \frac{\int_i \left(\gamma_{ig}y_{ig} + a_{ig}e_{ig}^A\sigma_{ig}d_{ig} - b_{ig}z_{ig}^A\varepsilon_{ig}y_{ig}\right)}{\int_i \left(\varepsilon_{ig}y_{ig} + \sigma_{ig}d_{ig}\right)}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

Note that the multiplier λ_g now reflects the aggregate externality that a change in the world price exerts through the political-influence term and both environmental externalities, on the consumption and production side.

To simplify, let us focus on the case of symmetric countries and constant semi-elasticities, and consider the best local agreement. It is easy to see that the gradient of $\Omega_g(e_g, z_g, p_g(e_g, z_g))$ at the NE standards points in the direction of increasing e_g and decreasing z_g if $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N > 0$ (where we used $d_g = y_g$ from symmetry and market clearing), and vice-versa if $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N > 0$. This is intuitive, as $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N$ is simply the aggregate world-price externality evaluated at NE standards: if it is positive the agreement calls for an increase in the world price, which in turn calls for loosening product standards and tightening process standards; and vice-versa.

In the appendix we show that there exists a threshold $\tilde{\gamma}_g \geq 0$ such that $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N$ is negative if $\gamma_g \in \left(0, \tilde{\gamma}_g\right)$ and positive if $\gamma_g > \tilde{\gamma}_g$. Note that the range $\gamma_g \in \left(0, \tilde{\gamma}_g\right)$ is non-empty (i.e. $\tilde{\gamma}_g > 0$) if and only if $b_g\varepsilon_g z_g^N > a_g\sigma_g e_g^N$, as can easily be seen from the expressions above.

The cooperative and noncooperative standards are depicted as functions of γ_g in Figure 4, which focuses on the case where the interval $(0, \tilde{\gamma}_g)$ is nonempty (the fact that we have drawn the z_g schedules above the e_g schedules has no significance). Figure 4 is essentially a combination of Figures 1 and 2, but it shows that the agreement always changes product and process standards in opposite directions.

Figure 4: Deep Integration with Product and Process Standards
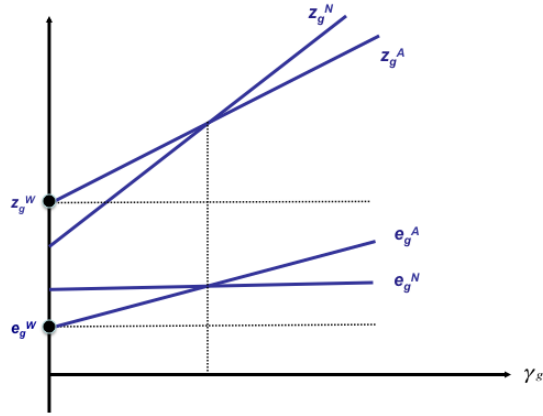
We now consider the welfare implications of this agreement. For $\gamma_g = 0$, and hence for γ_g small enough, the agreement is obviously good for you. The more interesting question is what happens for large γ_g. In the appendix we show that if γ_g is large enough, the agreement is good for you if a_g/b_g is sufficiently large, and it is bad for you if a_g/b_g is sufficiently small. The intuition is the following. Suppose we fix a_g and make the production externality b_g very small. Then process standards are primarily used for political objectives, rather than for environmental objectives, and as we saw earlier, an agreement tends to improve the efficiency of process standards relative to NE when lobbying pressures are strong, hence welfare goes up. A similar intuition applies if we fix b_g and make a_g small.

The overall conclusion is that taking into account the interaction between product and process standards introduces some qualifications to, but does not change the essence of, our earlier results.

6.2 Comprehensive agreement

We now consider a scenario where countries start from the non-cooperative equilibrium and negotiate over tariffs, product standards and process standards.

6.2.1 Non-cooperative equilibrium

Government i solves:

$$\max_{\{\tau_{ig}, e_{ig}, z_{ig}\}} \Omega_{ig} = \left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right) + S_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right) - a_{ig} e_{ig} d_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right)$$
$$- b_{ig} z_{ig} y_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right) + \tau_{ig} \left[d_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right) - y_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right)\right],$$

where we keep in mind that $\tau_{ig} = 0$ for $i \in \mathcal{X}_g$. It is direct to verify that non-cooperative policies and world prices satisfy:

$$\tau_{ig}^N = \begin{cases} \frac{\gamma_{ig} y_{ig} + a_g \sigma_g e_g^N - b_g \varepsilon_g z_g^N}{\varepsilon_{ig} y_{ig} + \sigma_{ig} d_{ig}} & \text{for } i \in \mathcal{M}_g \\ 0 & \text{for } i \in \mathcal{X}_g \end{cases}$$

$$e_{ig}^N = -\frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}} + \frac{\sigma_{ig} \tau_{ig}^N}{a_{ig}}}$$

$$z_{ig}^N = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1 + \gamma_{ig}}{b_{ig}} - \frac{\varepsilon_{ig} \tau_{ig}^N}{b_{ig}}}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

Note that the tariff is now used not only for the usual political motive, but also to address the consumption externality (through its consumption-tax component) and the production externality (through its production-tax component). As a consequence, for importing countries the product standard e is adjusted upwards (because part of its job is done by the tariff) and the process standard z is adjusted downwards (because the tariff increases the producer price so it works in the 'wrong' direction). For exporting countries, nothing has changed except that all variables are now evaluated at the new world prices.

6.2.2 Cooperative policies

Cooperative policies can now be found by solving:

$$\max_{\{\tau_{ig}, e_{ig}, z_{ig}\}, p_g} \Omega_g = \int_i \left\{\left(1 + \gamma_{ig}\right) \pi_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right) + S_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right) - a_{ig} e_{ig} d_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right)\right.$$
$$\left. - b_{ig} z_{ig} y_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right) + \tau_{ig} \left[d_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right) - y_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right)\right]\right\}$$

$$\text{s.t.} \quad \int_i y_{ig} \left(p_g - \frac{1}{z_{ig}} + \tau_{ig}\right) = \int_i d_{ig} \left(p_g + \frac{1}{e_{ig}} + \tau_{ig}\right),$$

where as usual we keep in mind that $\tau_{ig} = 0$ for $i \in \mathcal{X}_g$. Denoting the lagrangian multiplier by λ_g, the cooperative policies and world prices jointly solve:

$$\tau_{ig}^A = \begin{cases} \frac{\gamma_{ig}y_{ig} + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N}{\varepsilon_{ig}y_{ig} + \sigma_{ig}d_{ig}} - \lambda_g \text{ for } i \in \mathcal{M}_g \\ 0 \text{ for } i \in \mathcal{X}_g \end{cases}$$

$$e_{ig}^A = \frac{\sigma_{ig}}{2} + \sqrt{\left(\frac{\sigma_{ig}}{2}\right)^2 + \frac{1}{a_{ig}} - \frac{\left(\tau_{ig}^A + \lambda_g\right)\sigma_{ig}}{a_{ig}}}$$

$$z_{ig}^A = -\frac{\varepsilon_{ig}}{2} + \sqrt{\left(\frac{\varepsilon_{ig}}{2}\right)^2 + \frac{1 + \gamma_{ig}}{b_{ig}} - \frac{\left(\tau_{ig}^A + \lambda_g\right)\varepsilon_{ig}}{b_{ig}}}$$

$$\lambda_g = \frac{\int_{i \in \mathcal{X}_g}\left(\gamma_{ig}y_{ig} + a_g\sigma_g e_g^A - b_g\varepsilon_g z_g^A\right)}{\int_{i \in \mathcal{X}_g}\left(\varepsilon_{ig}y_{ig} + \sigma_{ig}d_{ig}\right)}$$

$$\int_i y_{ig} = \int_i d_{ig}$$

The most interesting difference relative to our standards-only models is that the multiplier λ_g now integrates only over exporting countries $i \in \mathcal{X}_g$. The reason is that the political and environmental world-price externalities on importing countries are neutralized by their unilateral choice of tariffs, and the only externalities that remain are those on exporting countries. Thus exporter interests ultimately drive comprehensive agreements. Also note that if export subsidies were available there would be no role for a comprehensive agreement.

How does the agreement change tariffs and standards? Using similar arguments as in the previous sections, it can be shown that if lobbying pressures are sufficiently strong then the agreement decreases tariffs, loosens product standards, and tightens process standard, just as in our separate models. Intuitively, the purpose of the agreement in this case is to increase the world price in the least-costly way starting from the NE policies. There are three ways to do this: lowering tariffs, loosening product standards, and tightening process standards. At the NE, all three instruments are optimized conditional on the world price, thus changing each instrument causes a second-order loss conditional on the world price. For this reason, the least costly way to raise the world price is to change all three policies, in order to spread out the loss of surplus. This is reminiscent of a well-known general principle of public finance: in a second best world it is optimal to spread out distortions across all instruments.

How does the agreement affect welfare? Notice that the comprehensive agreement we are focusing on effectively combines shallow and deep integration. Recalling that in our earlier model shallow integration tends to be good for you, while deep integration can be good or

bad for you, depending on whether negotiations are over process or product standards (as well as on the strength of lobbying pressures), we should expect subtle counteracting welfare effects. We are currently investigating this in ongoing work.

7   Conclusion

In this paper we ask whether trade agreements improve welfare if governments are subject to lobbying pressures. We consider shallow agreements, which consider only import tariffs, and deep agreements, which focus on behind-the-border policies. At a broad level, the answer depends on whether trade agreements intensify or dilute the influence of lobbies on policy choices, and this in turn depends on whether the interests of producer lobbies in different countries are in harmony or in conflict with respect to the policies on the negotiating table.

We find that shallow agreements tend to be good for you, because they pit exporter interests against import-competing interests, thereby inducing counter-lobbying. On the other hand, deep agreements tend to be bad for you when they deal with consumption-side policies and good for you when they deal with production-side policies, at least when political economy forces are strong. This is because the interests of domestic and foreign producers are aligned when it comes to consumption-side policies, while they collide when it comes to production-side policies. Finally, the presence of international ownership linkages tends to worsen the welfare implications of trade agreements, because it reduces the distortions in unilateral policies while it has little effect on cooperative policies.

We have stacked the deck against finding positive welfare effects of international agreements, by assuming small countries and by focusing on local rather than global consumption/production externalities. If countries are large they will be tempted to manipulate terms-of-trade, and this introduces an additional (purely economic) motive for trade agreements, which intuitively should increase the welfare gain from trade agreements. Likewise, the presence of global consumption or production externalities would introduce a new international (non-pecuniary) externality from policy choices, and thus a further welfare gain from international agreements. But even when these further potential welfare gains from agreements are introduced, our main points should still be valid, as they speak to the question of whether the welfare gains from trade agreements are diminished or enhanced when lobbies have more influence on policy-making.

Finally, there are a number of further extensions of our model that are worth pursuing.

In particular, we have focused on global trade agreements, but it seems important to explore also whether regional and preferential trade agreements are good for you. And while we have focused on deep agreements that deal with product and process regulations, it would be interesting to explore whether our conclusions can be generalized to other policy areas, such as labor standards, IPR policies, FDI policies and migration policies.

8 Appendix

Proof of Proposition 1

Let $\left(\{\tau_{ig}^A\}_{i\in\mathcal{M}_g}, p_g^A\right)$ be the cooperative tariffs and world prices, and let $\left(\{\hat{\tau}_{ig}(\kappa_g)\}_{i\in\mathcal{M}_g}, \hat{p}_g(\kappa_g)\right)$ be the solution to the following system:

$$\tau_{ig} = \frac{\gamma_{ig}y_{ig}(p_g+\tau_{ig})}{-m'_{ig}(p_g+\tau_{ig})} - \kappa_g, \quad i\in\mathcal{M}_g$$

$$\int_{i\in\mathcal{M}_g} m_{ig}\left(p_g+\tau_{ig}\right) = \int_{i\in\mathcal{X}_g} x_{ig}\left(p_g\right)$$

Note that $\left(\{\tau_{ig}^N\}_{i\in\mathcal{M}_g}, p_g^N\right) = \left(\{\hat{\tau}_{ig}(0)\}_{i\in\mathcal{M}_g}, \hat{p}_g(0)\right)$ and $\left(\{\tau_{ig}^A\}_{i\in\mathcal{M}_g}, p_g^A\right) = \left(\{\hat{\tau}_{ig}(\lambda_g)\}_{i\in\mathcal{M}_g}, \hat{p}_g(\lambda_g)\right)$. We will show $\frac{\partial\hat{\tau}_{ig}}{\partial\kappa_g} < 0$ and $\frac{\partial\hat{p}_g}{\partial\kappa_g} > 0$, which together with $\lambda_g > 0$ will imply $\tau_{ig}^A < \tau_{ig}^N$. In what follows we omit hats for simplicity:

$$\frac{\partial\tau_{ig}}{\partial\kappa_g} = \frac{\gamma_{ig}y_{ig}m''_{ig} - \gamma_{ig}y'_{ig}m'_{ig}}{\left(m'_{ig}\right)^2}\left(\frac{\partial p_g}{\partial\kappa_g} + \frac{\partial\tau_{ig}}{\partial\kappa_g}\right) - 1$$

$$= \frac{\gamma_{ig}y_{ig}m''_{ig} - \gamma_{ig}y'_{ig}m'_{ig}}{\left(m'_{ig}\right)^2 + \gamma_{ig}y'_{ig}m'_{ig} - \gamma_{ig}y_{ig}m''_{ig}}\frac{\partial p_g}{\partial\kappa_g} - \frac{\left(m'_{ig}\right)^2}{\left(m'_{ig}\right)^2 + \gamma_{ig}y'_{ig}m'_{ig} - \gamma_{ig}y_{ig}m''_{ig}}$$

$$\frac{\partial p_g}{\partial\kappa_g} = \frac{\int_{i\in\mathcal{M}_g} m'_{ig}\frac{\partial\tau_{ig}}{\partial\kappa_g}}{\int_{i\in\mathcal{X}_g} x'_{ig} - \int_{i\in\mathcal{M}_g} m'_{ig}} = \frac{\int_{i\in\mathcal{M}_g}\frac{-\left(m'_{ig}\right)^3}{\left(m'_{ig}\right)^2+\gamma_{ig}y'_{ig}m'_{ig}-\gamma_{ig}y_{ig}m''_{ig}}}{\int_{i\in\mathcal{X}_g} x'_{ig} + \int_{i\in\mathcal{M}_g}\frac{-\left(m'_{ig}\right)^3}{\left(m'_{ig}\right)^2+\gamma_{ig}y'_{ig}m'_{ig}-\gamma_{ig}y_{ig}m''_{ig}}}$$

Note that concavity of Ω_{ig} in τ_{ig} implies $\left(m'_{ig}\right)^2 + \gamma_{ig}y'_{ig}m'_{ig} - \gamma_{ig}y_{ig}m''_{ig} < 0$, therefore $\frac{\partial p_g}{\partial\kappa_g} > 0$. Hence $\frac{\partial\tau_{ig}}{\partial\kappa_g} < 0$ iff

$$\frac{\int_{i\in\mathcal{M}_g}\frac{-\left(m'_{ig}\right)^3}{\left(m'_{ig}\right)^2+\gamma_{ig}y'_{ig}m'_{ig}-\gamma_{ig}y_{ig}m''_{ig}}}{\int_{i\in\mathcal{X}_g} x'_{ig} + \int_{i\in\mathcal{M}_g}\frac{-\left(m'_{ig}\right)^3}{\left(m'_{ig}\right)^2+\gamma_{ig}y'_{ig}m'_{ig}-\gamma_{ig}y_{ig}m''_{ig}}} < \frac{\left(m'_{ig}\right)^2}{\gamma_{ig}y_{ig}m''_{ig} - \gamma_{ig}y'_{ig}m'_{ig}}$$

which is true since $\frac{\partial p_g}{\partial\kappa_g} > 0$ implies $LHS < 1$ and $RHS > 1$. This proves $\frac{\partial\tau_{ig}}{\partial\kappa_g} < 0$. QED

Proof of Proposition 2

Let $\hat{W}_g(\kappa_g)$ be the global welfare level associated with $\left(\{\hat{\tau}_{ig}(\kappa_g)\}_{i\in\mathcal{M}_g}, \hat{p}_g(\kappa_g)\right)$. We will show that $\frac{\partial\hat{W}_g}{\partial\kappa_g} > 0$ and hence the equilibrium trade agreement improves global welfare relative

to the non-cooperative equilibrium. Again we omit hats in what follows, and we keep in mind that $\tau_{ig} = 0$ for $i \in \mathcal{X}_g$:

$$W_g(\kappa_g) = \int_i \left[\pi_{ig} \left(p_g(\kappa_g) + \tau_{ig}(\kappa_g) \right) + S_{ig} \left(p_g(\kappa_g) + \tau_{ig}(\kappa_g) \right) + \tau_{ig}(\kappa_g) m_{ig} \left(p_g(\kappa_g) + \tau_{ig}(\kappa_g) \right) \right]$$

$$
\begin{aligned}
\frac{\partial W_g}{\partial \kappa_g} &= \int_{i \in \mathcal{M}_g} \left[y_{ig} \frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g} - d_{ig} \frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g} + \frac{\partial \tau_{ig}}{\partial \kappa_g} m_{ig} + \tau_{ig} m'_{ig} \frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g} \right] \\
&\quad + \int_{i \in \mathcal{X}_g} \left(y_{ig} \frac{\partial p_g}{\partial \kappa_g} - d_{ig} \frac{\partial p_g}{\partial \kappa_g} \right) \\
&= \int_{i \in \mathcal{M}_g} \tau_{ig}(\kappa_g) m'_{ig} \left(p_g(\kappa_g) + \tau_{ig}(\kappa_g) \right) \frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g}
\end{aligned}
$$

Next note that

$$\frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g} = - \frac{\int_{i \in \mathcal{X}_g} x'_{ig}}{\int_{i \in \mathcal{X}_g} x'_{ig} + \int_{i \in \mathcal{M}_g} \frac{-\left(m'_{ig} \right)^3}{\left(m'_{ig} \right)^2 + \gamma_{ig} y'_{ig} m'_{ig} - \gamma_{ig} y_{ig} m''_{ig}}} \frac{\left(m'_{ig} \right)^2}{\left(m'_{ig} \right)^2 + \gamma_{ig} y'_{ig} m'_{ig} - \gamma_{ig} y_{ig} m''_{ig}} < 0.$$

Then it is clear that if the agreed-upon tariffs are non-negative, the result follows. More generally, note that the welfare gain from the agreement is

$$W_g(\lambda_g) - W_g(0) = \int_{\kappa_g = 0}^{\lambda_g} \left[\int_{i \in \mathcal{M}_g} \tau_{ig}(\kappa_g) m'_{ig} \left(p_g(\kappa_g) + \tau_{ig}(\kappa_g) \right) \frac{\partial \left(p_g + \tau_{ig} \right)}{\partial \kappa_g} \right] d\kappa_g$$

Thus it is clear that the agreement improves global welfare even if the agreed-upon tariffs $\tau_{ig}(\lambda_g)$ are negative, as long as they are not too large. QED

Proof of Proposition 3

We have already established that the best local agreement loosens all product standards. What remains to be shown are our claims that this local result also holds globally if (1) countries are sufficiently symmetric, or (2) if σ_{ig} is sufficiently close to constant: (1) Suppose countries are symmetric. The gradient $\nabla \Omega_g \left(\mathbf{e}_g, p_g \left(\mathbf{e}_g \right) \right)$ then collapses to a univariate function so that concavity of $\Omega_g \left(\mathbf{e}_g, p_g \left(\mathbf{e}_g \right) \right)$ is enough to imply $e_{ig}^A > e_{ig}^N$. (2) Suppose σ_{ig} is constant for all i and g. It is then immediate from comparing equations (8) and (10) that $e_{ig}^A > e_{ig}^N$. Our claims then follow from continuity. QED

Proof of Proposition 4

We prove the result for the symmetric case. The claim then follows from continuity. We omit the g and i indices for simplicity. First note that $\frac{de^N}{d\gamma} = 0$, so W^N is independent of γ. Also, it is obvious that if $\gamma = 0$ then $W^A > W^N$, and thus the same holds if γ is low enough.

The next step is to show that $\frac{de^A}{d\gamma} > 0$. Note

$$\frac{de^A}{d\gamma} = -\frac{\frac{d^2}{ded\gamma}\Omega\left(e, p\left(e\right), \gamma\right)}{\frac{d^2}{de^2}\Omega\left(e, p\left(e\right), \gamma\right)}$$

The denominator is negative by our concavity assumption. Let us study the sign of the numerator:

$$\frac{d}{d\gamma}\Omega\left(e, p\left(e\right), \gamma\right) = \pi\left(p\left(e\right)\right)$$
$$\frac{d^2}{ded\gamma}\Omega\left(e, p\left(e\right), \gamma\right) = y\frac{dp}{de} = -\frac{yd'}{e^2\left(y' - d'\right)} > 0$$

Since e^A maximizes welfare when $\gamma = 0$, $\frac{de^A}{d\gamma} > 0$, and global welfare is concave in e, then W^A is decreasing in γ.

Next we show that $W^A < W^N$ for γ large enough. The key is to argue that e^A increases in an unbounded way as γ increases. To see this, note that e^A satisfies

$$e^2 + \frac{\sigma\varepsilon y}{y\varepsilon - d\sigma}e = \frac{\sigma y}{a\left(y\varepsilon - d\sigma\right)}\gamma + \frac{1}{a}$$

Note that, as γ increases, e^A is bounded away from zero, and p stays bounded, because it satisfies $y\left(p\right) = d\left(p + \frac{1}{e}\right)$. Therefore y and d stay bounded as $\gamma \to \infty$. It then follows from the equation above that e^A increases in an unbounded way as γ increases. We can conclude that there exists some $\hat{\gamma}$ such that $W^A < W^N$.

Finally, recalling that W^A is decreasing in γ, it follows that the cutoff value $\hat{\gamma}$ is unique. QED

Proof of Proposition 5

Given the argument in the main text, what remains to be shown is that there exists a critical value $\hat{\gamma}_g$ such that $\frac{\partial\Omega_g}{\partial p_g}|_{NE} > 0$ if $\gamma_g > \hat{\gamma}_g$ and $\frac{\partial\Omega_g}{\partial p_g}|_{NE} < 0$ if $\gamma_g < \hat{\gamma}_g$: Note that $\frac{\partial\Omega_g}{\partial p_g}|_{NE} < 0$ if and only if $\int_i\left(\gamma_{ig}y_{ig} - b_{ig}z_{ig}^N y'_{ig}\right) > 0$. Note also that:

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$$\int_i \left(\gamma_{ig} y_{ig} - b_{ig} z_{ig}^N y_{ig}' \right) \tag{22}$$

$$= \int_i y_{ig} \left(\gamma_{ig} - b_{ig} z_{ig}^N \varepsilon_{ig} \right) \tag{23}$$

$$= \int_i y_{ig} \left[b_{ig} \left(z_{ig}^N \right)^2 - 1 \right] \tag{24}$$

Recall from (13) that z_{ig}^N increases with γ_g, with $\lim_{\gamma \to \infty} z_{ig}^N = \infty$, and obviously the same is true for $b_{ig} z_{ig}^{N^2} - 1$, thus $\int_i \left(\gamma_{ig} y_{ig} - b_{ig} z_{ig}^N y_{ig}' \right) > 0$ when γ_g is sufficiently large.

Next note from (22) that $\int_i \left(\gamma_{ig} y_{ig} - b_{ig} z_{ig}^N y_{ig}' \right) < 0$ when $\gamma_g = 0$. This implies that, if governments maximize welfare, NE standards are too tight.

The two observations above imply that there exists a critical value $\hat{\gamma}_g$ such that $\frac{\partial \Omega_g}{\partial p_g}|_{NE} > 0$ if $\gamma_g > \hat{\gamma}_g$ and $\frac{\partial \Omega_g}{\partial p_g}|_{NE} < 0$ if $\gamma_g < \hat{\gamma}_g$. QED.

Proof of Proposition 6

In the main text we have already established that $z_g^N > z_g^A$ for $\gamma_g < \hat{\gamma}_g$, that $z_g^N < z_g^A$ for $\gamma_g > \hat{\gamma}_g$ and that z_g^N is increasing in γ_g.

Next we argue that the cooperative standard z_g^A is increasing in γ_g. Given concavity of $\Omega_g \left(z_g, p_g \left(z_g \right), \gamma_g \right)$, the sign of $\frac{dz_g^A}{d\gamma_g}$ is the same as the sign of $\frac{d^2}{dz_g d\gamma_g} \Omega_g \left(z_g, p_g \left(z_g \right), \gamma_g \right)$, which is positive:

$$\frac{d^2}{dz_g d\gamma_g} \Omega_g \left(z_g, p_g \left(z_g \right), \gamma_g \right) = y_g \left(p_g - \frac{1}{z_g} \right) \left(\frac{dp_g}{dz_g} + \frac{1}{z_g^2} \right) = \frac{-y_g d_g'}{z_g^2 \left(y_g' - d_g' \right)} > 0$$

It is obvious that for $\gamma_g = 0$ the agreement increases welfare, and by continuity this is true also for γ_g small enough.

Next note from inspection of Figure 2 that $z_g^N > z_g^A > z_g^W$ if $\gamma_g > \hat{\gamma}_g$. Concavity of global welfare in z then implies that the agreement increases welfare for $\gamma_g > \hat{\gamma}_g$.

Finally, it is clear that $z_g^N = z_g^A$ for $\gamma_g = \hat{\gamma}_g$, thus for this value of γ_g the agreement does not change the welfare level. It is then easy to see that for γ_g in a left neighborhood of $\hat{\gamma}_g$ it must be $z_g^A > z_g^N > z_g^W$, and thus the agreement decreases welfare.

In Figure 2 we suppose that the TA decreases welfare for a single interval of γ_g, but in principle this could be the case for multiple disjoint intervals of γ_g. For this reason in our proposition we state only that the TA decreases welfare "for some intermediate interval of γ_g". QED

Proof of Proposition 7

(i) Suppose importers are symmetric, and γ_{ig} and θ_{iig} are the same across all countries. Let $\theta_{iig} = \theta_g$. Clearly, τ_g^A is independent of θ_g. Let $h_g(\tau_g) \equiv \frac{y_g^m(p_g(\tau_g)+\tau_g)}{-m_g'(p_g(\tau_g)+\tau_g)}$, where y_g^m is the importers' supply function. Then the NE tariff is defined by $\tau_g = [(1+\gamma_g)\theta_g - 1]h_g(\tau_g)$, hence $\frac{d\tau_g}{d\theta_g} = \frac{(1+\gamma_g)h_g(\tau_g)}{1-[(1+\gamma_g)\theta_g-1]h_g'(\tau_g)}$ and thus $\frac{d\tau_g}{d\theta_g}|_{\tau_g^N} = \frac{(1+\gamma_g)h_g(\tau_g)}{1-\tau_g\frac{h_g'(\tau_g)}{h_g(\tau_g)}}$. This implies that τ_g^N is increasing in θ_g given that the elasticity of h_g is less than one. Hence, the tariff cut brought about by the trade agreement is decreasing in the foreign ownership share $1 - \theta_g$ and can even become a tariff increase. Following the logic of the proof of Proposition 2, the welfare gains from the trade agreement are therefore decreasing in the foreign ownership share and can even turn into a welfare loss. The claim is clearly robust to introducing small asymmetries across countries.

(ii) If countries are close to symmetric, θ_g has negligible impact on the cooperative and non-cooperative policies, and hence the qualitative welfare conclusions do not change.

(iii) Suppose counries are symmetric. Then a decrease in θ_g unambiguously lowers and flattens the $z_g(\gamma_g)$ schedule. And given concavity of the welfare function, this reduces the welfare gain from the agreement (Δ) if γ_g is above the critical level defined by $z_g^N(\gamma_g;\theta_g) = z_g^A(\gamma_g)$. And from inspection of Figure 3 it is clear that if γ_g is small enough a decrease in θ_g raises Δ. QED

Proofs for Section 6.1

In the main text we claim that there exists $\tilde{\gamma}_g \geq 0$ such that $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N < 0$ if $\gamma_g \in (0, \tilde{\gamma}_g)$, and $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N > 0$ if $\gamma_g > \tilde{\gamma}_g$, where the interval $(0, \tilde{\gamma}_g)$ is non-empty iff $a_g\sigma_g e_g^N < b_g\varepsilon_g z_g^N$.

Using the first-order conditions for NE standards ($a_g e_g^2 - a_g e_g \sigma_g - 1 = 0$ and $b_g z_g^2 + b_g\varepsilon_g z_g - \gamma_g - 1 = 0$), we obtain

$$\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N = b_g z_{gN}^2 - 1 + a_g\sigma_g e_g^N.$$

We know that $a_g\sigma_g e_g^N > 0$ and is independent of γ_g. Also, z_g^N is increasing and unbounded in γ_g. It follows that $\gamma_g + a_g\sigma_g e_g^N - b_g\varepsilon_g z_g^N$ is increasing in γ_g, and is positive if γ_g is sufficiently large. And it is then obvious that $\tilde{\gamma}_g > 0$ if and only if $a_g\sigma_g e_g^N < b_g\varepsilon_g z_g^N$.

In the main text we also claim that, for γ_g large enough, the agreement is good for you if a_g/b_g is sufficiently large and bad for you if a_g/b_g is sufficiently small.

From inspection of Figure 3, if γ_g is above $\tilde{\gamma}_g$ the agreement moves e_g away from the

welfare-maximizing level and z_g towards the welfare-maximizing level. Thus the agreement is good for you if $z_g^N - z_g^A$ is large enough relative to $e_g^N - e_g^A$. Note that $z_g^N - z_g^A$ is governed by $\frac{\lambda_g \varepsilon_g}{b_g}$ and $e_g^N - e_g^A$ is governed by $\frac{\lambda_g \sigma_g}{a_g}$; it follows that $\frac{z_g^N - z_g^A}{e_g^N - e_g^A} \longrightarrow \infty$ as $\frac{a_g}{b_g} \to \infty$, hence the first claim. The second claim is proved analogously. QED

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