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ABSTRACT

On Trade Policy Preference and Offshoring Ties*

This paper unpacks the role of the domestic content of imports as a novel source of policy interdependence along the global supply chain. We show how a rise in local contents embodied in imports can skew national trade policy preferences, and pull upstream and downstream countries in asymmetric ways with respect to (i) the nature of unilaterally optimal trade policy prescriptions, and (ii) the attractiveness of leveraging market access-based dispute settlement procedures. We discuss the pros and cons of deep trade integration as a remedy, involving well-enforced labor standards both upstream and downstream as an integral part of trade agreements.

JEL Classification: F11, F13, F16, F66, O19, O24

Keywords: offshoring, dispute settlement reciprocity, labor standards

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1 Introduction

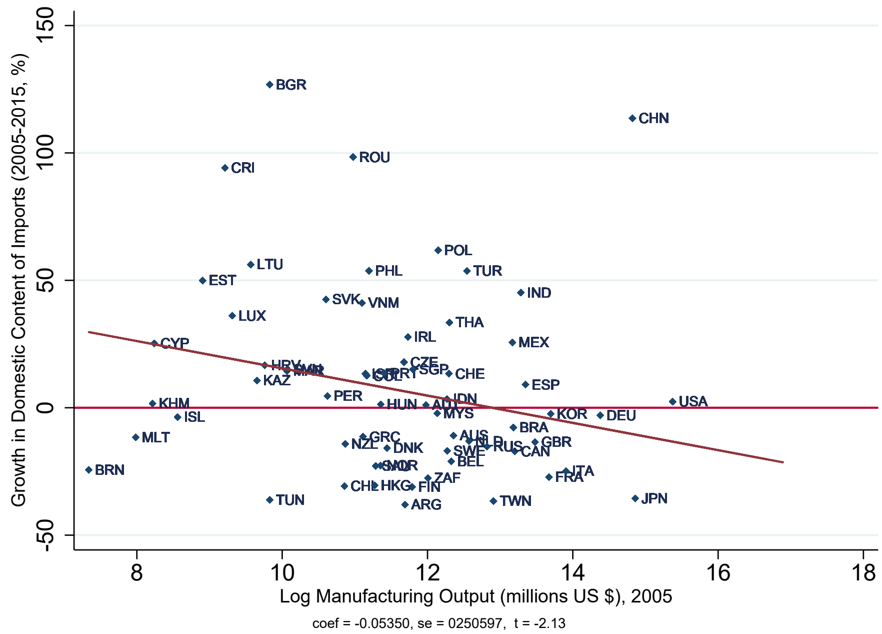
Offshoring is an ubiquitous feature of global production and international trade. Reduction in trade barriers and changes in information and communications technology have made possible the routinization of tasks and improvements in business-to-business coordination across long distances. These factors have contributed to a drastic reduction in the cost of production fragmentation facilitated by the offshoring of tasks worldwide. The growth in offshoring relationships along the global supply chain precipitates a novel type of interdependence between trade partners, hitherto underappreciated in a growing literature on offshoring. To wit, upstream (often developing) countries export offshored labor services to downstream (often developed) countries, only to import final products from downstream countries that contain their own countries' labor content. In this paper, we scrutinize the nature of this new form of interdependence between trade partners with offshoring ties, and show how a country's position along the global supply chain can shape trade policy preferences in asymmetric ways, and re-script the effectiveness of trade rules that are meant to enforce trade agreement, and settle trade disputes.

Trade in intermediate inputs now comprises a sizeable share of global trade. According to OECD estimates, over 50% of the value of imports in OECD economies are intermediate inputs (Miroudot, Lanz and Ragoussis 2009). As high as two-thirds of total merchandise imports for many OECD countries comprised of imported intermediate goods (Johnson and Noguera 2012).[1] Across all trade partner pairs from 1995-2018 included in the OECD Trade in Value Added data set (Table 1), the average domestic content share of manufacturing imports, which measures the domestic value added embodied in gross imports divided by the value of gross imports, is in fact quite modest at 0.36%.[2] The scenario is more nuanced at the country-level over time, however. To see this, we take the mean long difference in the total domestic content of manufacturing import by importing country between 2005 and 2015, and plot this difference against the initial log scale of manufacturing production in 2005. Figure 1 displays the resulting picture, which shows quite clearly the phenomenal rise in the domestic content of imports in

[1] Of comparable magnitudes, between 1992 and 2008, offshored production from foreign countries contributed to 56% of China's total exports (Sheng and Yang 2017). Imported content comprised 44% of EU exports in 2000 (European Central Bank 2005). In the US, the import content of exports ranged between 12 - 13% from 2008 - 2013 based on OECD statistics on trade and value added.

[2] Based on our calculations using the OECD Trade in Value Added (TiVA) data set across 66 countries from 1995-2018.

Figure 1: Growth in Domestic Content of Imports (2005-2015)



a large cross-section of countries. Manufacturing hubs such as China, Mexico and India not surprisingly saw some of the highest rates of increase in domestic content of imports. Outside of this group, Figure 1 shows that on average the more nascent a country's manufacturing industry in 2005, the larger and the more positive the change in domestic content of imports has been in the ten years between 2005 and 2015. What are the implications of this form of interdependence between upstream and downstream countries on trade policy preference? To what extent can the principles that have guided the multilateral trading system decades before the onset of global offshoring, such as market access and dispute settlement reciprocity, continue to guide countries to make and sustain efficient trade agreements?

To answer these questions, we modify the canonical Grossman and Rossi-Hansberg (2008) model of international task offshoring. Our model features a continuum of varieties of final products in a two-country setting, accommodating two-way trade in a continuum of final product varieties, and two-way trade in tasks along a continuum of tasks spectrum. These two-way trades in goods and tasks are respectively facilitated by heterogeneous product varieties depending on country of origin, as well as international differences in labor supply, and labor productivity in select tasks. We perform simple comparative statics to formally demonstrate that own-tariff wage responses in the two countries are asymmetric, if the domestic labor contents of imports in the two countries are sufficiently divergent. Specifically, an import tariff by a *more upstream* country can have adverse local wage consequences if the domestic labor content of import is sufficiently high. This occurs because a tax on imports is a tax on the use of local workers employed upstream in the production process of imports. An import tariff by a *more downstream* country, however, can benefit domestic workers, as it lowers offshoring cost by pushing down the upstream wage.[3] The resulting positive effect on downstream wages is reminiscent of the productivity effect of an offshoring cost reduction by now well-understood and empirically verified in the literature (Grossman and Rossi-Hansberg 2008, Ottaviano, Peri and Wright 2013).

These asymmetric, own-tariff wage responses suggest that offshoring ties can introduce interesting asymmetries in the trade policy preferences of upstream and downstream countries, where a pro-trade bias becomes more likely among countries upstream in view of the adverse wage (and thus terms of trade with task exports) consequences of import tariffs, while import protection continues to confer unilateral terms of trade gains downstream. We flesh out these intuitions in three steps, by exploring (i) the nature and maintenance of first best import tariff agreements, (ii) the Nash equilibrium in import tariffs, and (iii) the possibility of deep trade integration that takes into account minimum labor standards in charting trade agreements.

According to GATT Article 22.4 of the Dispute Settlement Understanding, a trade agreement violation or withdrawal of concessions by any one party is to be met by an equivalent and compensatory market access rebalancing, leaving the value of trade unchanged for all parties concerned (Anderson 2002, WTO 2005). In a seminal paper, Bagwell and Staiger (1999) shows that market access reciprocity can guide self-interested countries to sign efficient trade agreements. Similarly, dispute settlement reciprocity negates incentives for trade agreement violations. The underlying model that justified these features of a trade agreement is a trade in final goods model, where the salient features of economies engaged in offshoring relationships are not accounted for. We check and affirm the importance of market access reciprocity in enforcing first best trade agreements in the context of our model with offshoring ties, and derive the analog of market access rebalancing required to eliminate trade violation incentives.

[3] For example, Chen (2022) studies the effect of Chinese boycott of Japanese cars on China's automobile supply chain, and finds a 10% to 15% employment reduction from the auto parts manufacturers located near the Japanese joint venture firms after the boycott.

In so doing, we furnish a revised equivalent retaliatory tariff formula, as one that maintains a constant level of factor content of trade weighted terms of trade after a trade violation.

We then explore the properties of the revised equivalent retaliatory tariff formula to gain insights. In particular, we show that an eye for an eye type retaliatory tariff may no longer be able to deliver the constant level of factor content of trade weighted terms of trade required to mitigate downstream incentives to unilaterally deviate from a first best trade agreement. Indeed, in response to downstream protectionism in violation of a free trade agreement, upstream import protection may end up benefiting the downstream nation if own-tariff wage response in the upstream country is negative, thus encouraging the violation even further. We derive conditions under which the equivalent tariff response that rebalances terms of trade subsequent to a downstream protectionist violation is in fact an import subsidy. Here, the pro-trade bias of offshoring in upstream countries manifests either in the form of (i) an import subsidy to counter unilateral protectionism downstream, or (ii) an inability to issue terms of trade rebalancing retaliation if subsidies are not feasible due to government budget constraints. Without effective retaliation in the punishment phase, a trade agreement with dispute settlement reciprocity cannot prevent trade wars.

What then is the nature of an all out tariff war with offshoring ties, when free trade agreements may be hard to enforce? We derive the best responses in import tariffs for the upstream and downstream countries respectively. Interestingly, we find that trade preference asymmetries between upstream and downstream countries take the form of asymmetric shifts in the tariff best responses due to offshoring ties. The more upstream country's best response shifts in a pro-trade fashion relative to a no-offshoring benchmark, with lower import taxes or higher import subsidies depending on the domestic content of imports. The more downstream country's best response shifts relative to a no-offshoring benchmark to reflect even more protectionist tendencies. The insight gained is thus that offshoring alters the nature of equilibrium tariffs in an all out trade war as well. A novel concern that directly follows is that if the best that an upstream country can do is free trade in an all out tariff war because of the pro-trade bias inherent in a upstream position, the prospect of achieving a first best trade agreement (with free trade) is dim. This is particularly relevant if revenue considerations prohibit the use of import subsidies in a trade war, as well as the use of side payments to compensate downstream countries as incentives to sign trade agreements.

In view of these trade preference asymmetries and the possibility that trade agreements cannot be credibly enforced, we propose a potential remedy. In particular, we explore the role of deep trade integration that jointly takes into account the efficiency and trade agreement enforcement consequences of trade and minimum labor standards (e.g. well-enforced and binding minimum wages in the two countries). We show that credibly enforced minimum labor standards can accomplish what an equivalent retaliatory tariff is supposed to accomplish – to maintain a stable factor content of trade weighted terms of trade. In so doing, we shed new light on the potential role for labor standards as a precondition that can facilitate the signing and maintenance of trade agreements between countries along the global supply chain.[4]

This paper is related to a growing volume of studies on offshoring that has so far been concerned primarily with the wage and employment consequences of offshoring. The benefits of offshoring in terms of employment generation and wage increases in the offshoring country have been shown in a number of studies (e.g. Mankiw and Swagel 2006, Harrison and McMillan 2011, Ottaviano, Peri and Wright 2013, Hummels Munch and Xiang 2016).[5] Most of this literature focusses on downstream developed countries in the global supply chain, with few exceptions. For example, Feenstra and Hanson (1996, 1997) examine the impact of offshoring on wage inequality between developed and developing countries, and show that the skill intensities of the tasks offshored play a critical role. Davidson, Matusz and Shevchenko (2008) presents a two-country model of offshoring with search friction. A reduction in the cost of posting a vacancy in the developed country is shown to increase offshoring, and raise wages. Bergin, Feenstra and Hanson (2011) shows that offshoring stabilizes wages in the developed country, while adding volatility to developing country wages as offshoring activities respond to business cycle effects. Bandyopadhyay et al. (2020) formulates a model of tasks offshoring, and show that whether a developing country benefits from offshoring cost reducing technological change in general equilibrium depends in a nuanced way on the labor demand elasticities in the two

[4]Some recent examples include the Trans-Pacific Partnership (TPP) and the Trans-Atlantic Trade and Investment Partnership (TTIP), where the promotion of labor standards among all member is an explicit goal.

[5]Mankiw and Swagel (2006) examines employment levels in the overseas affiliates of US multinational firms and the US parent. Harrison and McMillan (2011) argues in favor of a more nuanced look at the offshoring and employment relationship, and specifically the need to distinguish between horizontal and vertical foreign investment. Ottaviano, Peri and Wright (2013) introduces competition with both immigrant workers as well as native workers as an additional mediating factor. Other studies include Mitra and Ranjan (2010), which introduces search friction into the Grossman and Rossi-Hansberg setting, and Ranjan (2013) which demonstrates the importance of labor market institutions such as employer-employee bargaining. Hummels, Munch and Xiang (2016) is an excellent survey of the literature.

countries. This paper contributes to the literature by shedding light on the potential perverse consequences of import protection on wages when the domestic labor content of imports is sufficiently high.[6]

This paper also contributes to the literature on the economics of international trade agreements, where the rationale behind market access rebalancing as a dispute settlement device has been extensively explored (e.g. Bagwell and Staiger 1999, Schwartz and Sykes (2002), Lawrence 2003, Kohler 2004, Howse and Staiger 2005). These studies do not take into account the difference that offshoring ties make to the nature and enforcement of trade agreements. The only exception is Antràs and Staiger (2012), which points out a hold-up problem that arises when contracts between buyers and producers are incomplete. In this setting, input trade subsidies and free trade in the final goods resolve the hold-up problem. Furthermore, if governments' objective include political economy considerations, reciprocity is no longer able to guide countries to reach an efficient trade agreement. Our paper departs from the contracting hold-up issue, and focuses instead on changes in trade preferences that arise when offshoring shifts the own-tariff wage responses in a way that may be harmful to workers upstream, but not to workers downstream. We check and state the nature that market access rebalancing should take in the presence of offshoring ties to enforce trade agreements, and point out potential pitfalls along the way (e.g. government budget constraints) that may constrain countries from executing equivalent rebalancing import tariff / subsidy retaliation.

Finally, this paper is also related to the globalization and labor standards literature, where the predominant focus is that globalization leads to a cut-throat race in developing countries' effort to outcompete one another in terms of wages. Some argued that strict regulation on labor standards deters participation and competition in the global economy (Collier and Dollar 2002), while other studies have shown how globalization can unleash a race to manipulate labor standards (Chau and Kanbur 2006, Olney 2013, McLaren and Im 2021). Despite these concerns, Rodrik (1996), Bakhshi and Kerr (2010) and Flanagan (2003) use proxies of labor rights (e.g. adoption of ILO conventions) and fail to find empirical support for a negative relationship between international labor standards and exports. Our paper contributes

[6] For studies that share the developing country focus of this paper but examine other aspects of offshoring, see for example, Díez (2014) that investigates the impact of tariffs on offshoring and intra-firm trade decisions in a North-South framework, and Burstein and Vogel (2010) in which the focus is on the impact of offshoring on the skill premium in Northern and Southern countries.

to this literature by staging the determinants of trade flows from the broader perspective of whether countries are able sign credible trade agreements with one another in the presence of an offshoring relationship.

2 Insights from Recent Trade Disputes

If offshoring ties indeed give rise to asymmetric trade policy preferences among upstream and downstream trade partners, one would expect realized trade policy disputes to reflect this asymmetry. For example, are trade disputes more common among upstream complainants and downstream respondents?

To preface the model, therefore, we offer suggestive, albeit non-causal, evidence of trade policy preference biases up and down the global supply chain.[7] We ascertain the extent to which the likelihood that a country confronts trade policy violations by trade partners is associated with the position of the country along the supply chain, and the intensity of the domestic content of imports in particular. In order to assess the relationship between the domestic content of imports and trade disputes, we construct a trade dispute incidence matrix across 4,290 ($= 66 \times 65$) country pairs from 1995-2018. For each importer(j)-exporter(i) pair at year t, we ascertain the likelihood that an importer country j launches a WTO dispute against exporter country i as a function of the intensity of the domestic (country j's) content of imports from i. We measure this intensity in two ways, including (i) a dummy variable (Domestic Content Dummy) which equals one when the domestic content of imports of j from i as a share of the value of total imports of j from i in any industry exceeds x% ($= 1, 3, 5, 7, 10\%$) in year t, and (ii) the domestic content of imports of j from i as a share of the value of total imports of j from i averaged across industries (Domestic Content Share) in year t. The domestic content of trade data comes from the OECD TiVA (Trade in Value Added) data set, covering 45 industrial sectors. Table 1 summarizes the data. On average, WTO trade disputes occurred in 0.24% of the country pairs. The domestic content of imports constitutes 0.36% of total imports on average. In 0.13% (0.45%, 0.87%, 1.9%, 8.8%) of the country pair-year observations, the domestic content

[7]Specific trade war episodes can also offer insights. In the US-China trade disputes that began in 2018, the trade war began with an eye for an eye type retaliation to start from January 2018 to August 2018. China's match of US's new trade restrictions decelerated in market access terms thereafter. Trade-weighted average U.S. tariff on Chinese products was at 3.1% in January 2018 compared to the 8.0% Chinese average. By September 2019, the U.S. average tariff and the Chinese average tariff converged at 21%. Chinese retaliation covered food and materials imports in the main, as well as electronics including televisions, cell phones, machinery, vehicles, medical instruments, and plastic products for example (Bown 2020).

of import as a share of total imports exceeds 10% (7%, 5%, 3%, 1%, respectively) in at least one industry. Interestingly, and just based on raw data, a country-pair is close to more than 37 (12, 6, 5, 7) times more likely to have engaged in a trade dispute with an exporting trade partner if the importer's domestic content of import from the exporter exceeds 10% (7%, 5%, 3%, 1% respectively) of total imports from the exporter in at least one industry.

Table 2 displays the results of a series of linear probability model regressions that assess the likelihood of an importer-launched trade dispute between an importer-exporter pair in year t as a function of the intensity of the domestic-content of import of the importer from the exporter at time t, with year, importer and exporter fixed effects, as well as year, importer-exporter pair fixed effects.[8] Column (1) measures the intensity of the domestic content of import using the domestic content share variable, controlling separately for year, importer and exporter fixed effects. The next two columns additionally account for scale effects, by respectively incorporating the value of manufacturing production of the importer (column 2), and the value of manufacturing production of the importer and the exporter separately (column 3). All three sets of regressions control for year, importer and exporter fixed effects. The next three columns repeat these regressions by introducing importer-exporter pair fixed effects to replace separate importer and exporter fixed effects. In all six regressions, an increase in the intensity of the domestic content of imports in the country pair increases the likelihood of an importer-launched trade dispute given our list of controls. Using Column 6 of Table 2 with country-pair fixed effects as a benchmark, a 1% increase in the domestic content share of imports increases the likelihood of an importer launched trade dispute by 0.30%. Given that trade disputes only occur in 0.24% of the country pairs in our data, this is a non-trivial increase in the risk of a trade dispute. It bears emphasis that these are non-causal associations. Nonetheless, we find these novel observations and associated mechanisms to be worthy of further investigation. We now turn to our model of offshoring and trade taxes.

3 A Simple Model of Offshoring and Trade Taxes

Consider a two-country (home (H) and foreign (F) setting, in which each country produces two tradable commodities x and y, where y is a homogeneous product, and serves as the

[8]We adopt the linear probability model due to the infrequency of trade disputes among many country pairs, and consequently the large number of perfect predicted outcomes ($>$ 95%) if, for example, a logit model is adopted.

model's numeraire good. Home's x sector produces a continuum of varieties $z_n \in [0, N]$, for home consumption, and varieties $z_{n^*} \in [0, N^*]$, for foreign consumption. Similarly, foreign's x sector produces a continuum of varieties $z_m \in [0, M]$, for home consumption, and varieties $z_{m^*} \in [0, M^*]$, for foreign consumption.[9] Let q_{z_n} and q_{z_m} denote home consumption of variety z_n and z_m respectively, and $q^*_{z_{n^*}}$ and $q^*_{z_{m^*}}$ denote foreign consumption of variety z_{n^*} and z_{m^*} respectively. q_y and q^*_y are the quantities of y consumed in the two countries.

Preferences of consumer i in the home country are represented by a utility function:

$$U(q_{iz_n}, q_{iz_m}, q_{iy}) = q_{iy} + \int_0^N u(q_{iz_n})dz_n + \int_0^M v(q_{iz_m})dz_m.$$

where $u(q_{iz_n}) = (\alpha - \gamma q_{iz_n}/2)q_{iz_n}$, and $v(q_{iz_m}) = (\alpha - \gamma q_{iz_m}/2)q_{iz_m}$. These yield consumer demand for each variety z_n and z_m as functions of market prices p_{z_n} and p_{z_m} respectively:[10]

$$q_{z_n}(p_{z_n}) = L(\alpha - p_{z_n})/\gamma, \;\; q_{z_m}(p_{z_m}) = L(\alpha - p_{z_m})/\gamma. \tag{1}$$

Similarly in the foriegn country,

$$U^*(q^*_{iz_{n^*}}, q^*_{iz_{m^*}}, q^*_{iy}) = q^*_{iy} + \int_0^{N^*} u^*(q^*_{iz_{n^*}})dz_{n^*} + \int_0^{M^*} v^*(q^*_{iz_{m^*}})dz_{m^*}$$

where $u^*(q^*_{iz_{n^*}}) = (\alpha^* - \gamma^* q^*_{iz_{n^*}}/2)q^*_{iz_{n^*}}$, and $v^*(q^*_{iz_{m^*}}) = (\alpha^* - \gamma^* q^*_{iz_{m^*}}/2)q^*_{iz_{m^*}}$. Consumer demand given prices $p^*_{z_{n^*}}$ and $p^*_{z_{m^*}}$ are:

$$q^*_{z_{n^*}}(p^*_{z_{n^*}}) = L^*(\alpha^* - p^*_{z_{n^*}})/\gamma^*, \;\; q^*_{z_{m^*}}(p^*_{z_{m^*}}) = L^*(\alpha^* - p^*_{z_{m^*}})/\gamma^*. \tag{2}$$

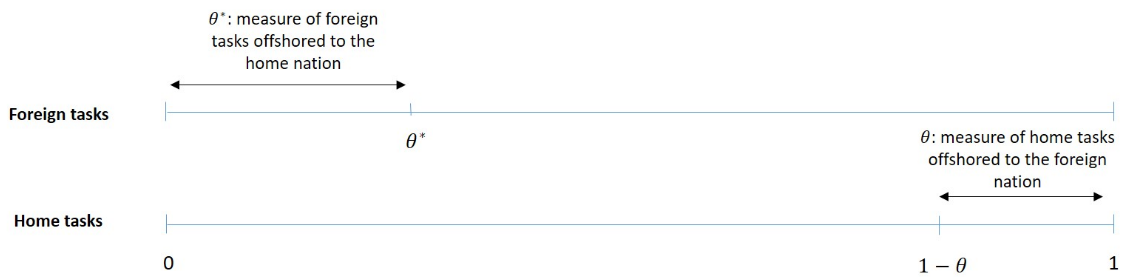
Production of y in the two countries are accomplished via production functions $Y(L_y) \geq 0$ and $Y^*(L^*_y) \geq 0$ both employing labor only ($L_y \geq 0$, and $L^*_y \geq 0$,) subject to strictly diminishing marginal returns. We assume furthermore that the corresponding labor demand schedules are given by $L_y(w) = \{L_y | \partial Y(L_y)/\partial L_y = w\} = \bar{L}_y - A_y w$ and $L^*_y(w^*) = \{L^*_y | \partial Y^*(L^*_y)/\partial L^*_y = w^*\} = \bar{L}^*_y - A^*_y w^*$ where $\bar{L}_y > 0$ and $\bar{L}^*_y > 0$ are labor demand shifters and $A_y > 0$ and $A^*_{y^*} > 0$ the corresponding slope terms.

Production of a unit of any variety of x requires a continuum of labor tasks $k \in [0, 1]$ to be performed. Task offshoring to the home country is feasible for a range $[0, \theta^*]$ of tasks in the foreign country, while $[1 - \theta, 1]$ denotes the range of production tasks in the home country that

[9] For the time being, these ranges are fixed, and role of endogenous entry will be addressed in Section 4.

[10] We have assumed here, for expositional clarity, that demand depends only on own-price effects. In section 4, we discuss this assumption by incorporating cross-substitution possibilities between varieties.

Figure 2: The Pattern of Task Offshoring



can be offshored to the foreign country, as shown in Figure 2. Some tasks are not offshorable, and thus we take $\theta^* < 1-\theta$. We assume henceforth that $\theta^* > \theta \geq 0$, meaning simply that with two-way offshoring, the home country is more upstream, and the foreign country more downstream. The share of offshorable tasks θ^* and θ are technologically given to producers in the two countries depending, for example, on the routine nature and skill intensity of the tasks performed.[11]

Without loss of generality, assume that workers in the foreign country are more productive – expressed in units of labor, each task offshored by the foreign country requires $\beta^*A^* > A^*$ number of home country workers to complete, when all tasks can be completed in the foreign country with A^* number of workers per task. $\beta^* > 1$ parameterizes worker productivity difference adjusted to account for any foreign offshoring cost in the home country. Meanwhile, let $\beta A < A$ be the number of foreign country workers required to produce each task offshored by the home country, where A denotes the unit labor requirement per task in the home country. Given simultaneous productivity differences $\beta \neq \beta^*$ and wage differences $w \neq w^*$, two-way offshoring is cost-minimizing in the two countries if and only if respectively $\beta^*A^*w < A^*w^*$ and $\beta Aw^* < Aw$, or equivalently

$$\beta^* < \frac{w^*}{w} < \frac{1}{\beta}. \tag{3}$$

By contrast, one way offshoring applies when for example $\beta^*A^*w - A^*w^* > 0$ and $\beta Aw^* - Aw < 0$, in which case only the home country should offshore tasks to the foreign country to minimize cost, and the foreign country minimizes cost by completing all tasks locally. If however $\beta^*A^*w - Aw < 0$ and $\beta Aw^* - Aw > 0$, then only the foreign country will find it cost minimizing to offshore tasks to be completed in the home country, while the home country

[11]Section 4 discusses the implications of endogenous offshoring shares in our setting.

completes all tasks locally to minimize cost. Henceforth we assume that the productivity gap between the two countries is large, so that $\beta^* \leq 1/\beta$, thus accommodating the possibility of two-way offshoring required in (3).

The home and foreign unit costs of production with two-way offshoring will thus embody both home and foreign country wage costs. In particular, denote $a = A(1-\theta)$ and $a_o = A\beta\theta$ as the home and foreign country labor requirements of a unit of the final good x supplied by the home country. Symmetrically, denote $a^* = A^*(1-\theta^*)$ and $a_o^* = A^*\beta^*\theta^*$ as the foreign and home country labor requirements of a unit of the final good x^* supplied by the foreign country. The corresponding unit costs of production for each of the $N + N^*$ and $M + M^*$ varieties are respectively

$$c(w, w^*) = aw + a_o w^* \text{ and } c^*(w, w^*) = a^* w^* + a_o^* w.$$

The two countries have at their disposal uniform specific tariffs t and t^* on all heterogeneous goods imports. With competitive pricing in the final demand of the heterogeneous good, prices and the corresponding aggregate demand in the home country are

$$\begin{aligned} p_{z_n} &= p_n(w, w^*) = c(w, w^*), \;\; Q_n(w, w^*) = N q_{z_n}(p_n(w, w^*)), \\ p_{z_m} &= p_m(w, w^*, t) = c^*(w, w^*) + t, \;\; Q_m(w, w^*, t) = M q_{z_m}(p_m(w, w^*, t)), \end{aligned} \tag{4}$$

while in the foreign country

$$\begin{aligned} p^*_{z_{n^*}} &= p^*_{n^*}(w, w^*, t^*) = c(w, w^*) + t^*, \;\; Q^*_{n^*}(w, w^*, t^*) = N^* q^*_{z_{n^*}}(p^*_{n^*}(w, w^*, t^*)), \\ p^*_{z_{m^*}} &= p^*_{m^*}(w, w^*) = c^*(w, w^*), \quad Q^*_{m^*}(w, w^*) = M^* q^*_{z_{m^*}}(p^*_{m^*}(w, w^*)). \end{aligned} \tag{5}$$

In line with these prices and aggregate consumption levels, the derived demand for labor in the two countries, L_x and L_x^*, come from four sources respectively. In the home country:

$$L_x(w, w^*, t, t^*) = a\left(Q_n(w, w^*) + Q^*_{n^*}(w, w^*, t^*)\right) + a_o^*\left(Q_m(w, w^*, t) + Q^*_{m^*}(w, w^*)\right), \tag{6}$$

to include direct employment in the production of final goods Q_n and $Q^*_{n^*}$, and employment to complete offshored foreign tasks in Q_m and $Q^*_{m^*}$. In the foreign country,

$$L^*_x(w, w, t, t^*) = a^*\left(Q_m(w, w^*, t) + Q^*_{m^*}(w, w^*)\right) + a_o\left(Q_n(w, w^*) + Q^*_{n^*}(w, w^*, t^*)\right), \tag{7}$$

to satisfy labor demand for final goods production in Q_m and $Q^*_{m^*}$ and to complete offshored home tasks in Q_n and $Q^*_{n^*}$.

Equations (6) and (7) fully characterize the own-wage, and cross-wage, as well as the own-tariff, and cross-tariff impacts on labor demand in the two countries, depending on the domestic content of imports in the two countries embodied in the (a, a_o) and (a^*, a_o^*) pairings. Strictly following standard intuitions, it can be shown that own-wage labor demand effects ($\partial L_x/\partial w$, $\partial L_x^*/\partial w^*$) are unambiguously negative, while cross-wage effects ($\partial L_x/\partial w^*$, $\partial L_x^*/\partial w$) are negative if and only if there is cross-border offshoring ($a_o > 0$ and / or $a_o^* > 0$).[12]

From (6) and (7), labor demand in the two countries are also subject to own- and cross-tariff influences. All else equal, cross-tariff effects on local labor demand ($\partial L_x/\partial t^*$, $\partial L_x^*/\partial t$) are always negative as expected, as tariff abroad depresses demand for production, and thus employment.[13] Interestingly, and relevant particularly for the analyses to follow, offshoring facilitates a perverse own-tariff effect on local labor demand. Specifically, using (6) - (7), it can be shown that all else constant,

$$\frac{\partial L_x}{\partial t} = -a_o^* ML/\gamma < 0, \quad \frac{\partial L_x^*}{\partial t^*} = -a_o N^* L^*/\gamma^* < 0$$

if and only if the domestic labor content of imports in two countries are respectively positive ($a_o^* > 0$ and $a_o > 0$). .

Using (6) - (7), as well as labor demand in the homogeneous sector ($L_y(w)$ and $L_y^*(w^*)$), full employment in the two countries respectively require that:

$$L = L_y(w) + L_x(w, w^*, t, t^*), \tag{8}$$

$$L^* = L_y^*(w^*) + L_x^*(w, w^*, t, t^*). \tag{9}$$

Our model yields closed-form general equilibrium solutions to wages, which in turn can be used to determine prices, employment, output levels and welfare. We show in the appendix that general equilibrium wages are functions of the two tariff rates, in the following form:

$$\begin{aligned} w(t, t^*) &= \omega_o + \omega_t t + \omega_{t^*} t^*, \\ w^*(t, t^*) &= \omega_o^* + \omega_t^* t + \omega_{t^*}^* t^* \end{aligned} \tag{10}$$

where ω_o and ω_o^* are functions of relative labor supply and consumption shares, along with technological parameters only, while general equilibrium own-tariff and cross-tariff responses

[12] Using (1) - (2), and (4) - (7), the own-wage response is given by $\partial L_x/\partial w = -a^2(NL/\gamma + N^*L^*/\gamma^*) - (a_o^*)^2(ML/\gamma + M^*L^*/\gamma^*) < 0$. The cross-wage response is: $\partial L_x/\partial w^* = -aa_o(NL/\gamma + N^*L^*/\gamma^*) - a_o^* a(ML/\gamma + M^*L^*/\gamma^*) < 0$ if and only if $a_o > 0$ and / or $a_o^* > 0$. The own- and cross-wage responses for L_x^* are analogous.

[13] Using (1) - (2), and (4) - (7), $\partial L_x/\partial t^* = -aN^*L^*/\gamma^* < 0$ and $\partial L_x^*/\partial t = -a^*ML/\gamma < 0$.

(ω_t, ω_{t^*} and $\omega^*_{t^*}$, ω^*_t respectively) are likewise fully characterized by the same list of relative labor and consumption share in addition to technological parameters.[14]

Proposition 1 *General equilibrium own-tariff wage effects are perverse if and only if the domestic content of imports is sufficiently high. In the home country:*

$$\frac{\partial w}{\partial t} \equiv \omega_t < (\geq)\ 0 \ \text{ if and only if } \frac{a_o^*}{a^*} > (\leq)\ \frac{a_o}{a}\left(\frac{a^2}{a_y^* + a_o^2}\right),$$

and in the foreign country:

$$\frac{\partial w^*}{\partial t^*} \equiv \omega^*_{t^*} < (\geq)\ 0 \ \text{ if and only if } \frac{a_o}{a} > (\leq)\ \frac{a_o^*}{a^*}\left(\frac{(a^*)^2}{a_y + (a_o^*)^2}\right).$$

General equilibrium cross-tariff wage effects are always negative:

$$\frac{\partial w}{\partial t^*} \equiv \omega_{t^*} < 0, \quad \frac{\partial w^*}{\partial t} \equiv \omega^*_t < 0.$$

a_y denotes normalized input requirement in y, with $A_y/((NL + ML)/\gamma + (N^*L^* + M^*L^*)/\gamma^*)$ while $a_y^* = A_y^*/((NL + ML)/\gamma + (N^*L^* + M^*L^*)/\gamma^*)$. Proposition 1 shows that an import tariff can backfire and harm local workers in the more upstream country. Put simply, a tax on imports is a tax on domestic labor demand when domestic labor contents are embodied in imports from abroad. Proposition 1 also shows that neither country is immune to this tendency as long as they are both engaged in some upstream tasks, but if the degree of upstreamness between the two countries are sufficiently divergent, say when

$$\frac{a_o^*}{a^*} > \frac{a_o}{a}\left(\frac{a^2}{a_y^* + a_o^2}\right), \quad \text{and} \quad \frac{a_o}{a} < \frac{a_o^*}{a^*}\left(\frac{(a^*)^2}{a_y + (a_o^*)^2}\right),$$

which applies, as a special case, when the foreign country is purely downstream ($a_o^* > 0 = a_o$), import tariffs may only backfire in the more upstream country and not downstream.

Given this tendency for import tariffs to have perverse own country wage effects in upstream countries,[15] we now turn to an analysis of the pros and cons of import tariffs in the presence of offshoring links in welfare terms.

[14] In the Appendix, we prove the existence of a unique interior equilibrium, along with the comparative statics results summarized in Proposition 1.

[15] As discussed earlier, Chen (2022) presents a first attempt that demonstrates this effect in the context of a consumer boycott on Japanese auto imports (a de facto tax on imports) on employment in auto-part factories in China.

3.1 Trade Policy Preference Asymmetries

Let W and W^* denote gross national products in the two countries plus government transfers of any tariff revenues to consumers. Adding up revenue from producing the homogeneous good, revenue from producing heterogeneous varieties net of the cost of offshored tasks, wage income from completing offshored tasks for the country's trading partner, as well as tariff revenues, we have:

$$\begin{aligned} W(w,w^*,t) &= Y(L_y) + w(L - L_y) + tQ_m(w,w^*,t), \\ W^*(w,w^*,t^*) &= Y^*(L_y^*) + w^*(L^* - L_y^*) + t^*Q_{n^*}^*(w,w^*,t^*). \end{aligned}$$

As all consumers maintain budget balance,[16] equilibrium indirect utility, with lump sum transfers of tariff revenues back to consumers, is given by:

$$V = W(w,w^*,t) + L^* \int_0^N \left(u(q_{iz_n}) - p_n q_{iz_n}\right) dz_n + L \int_0^M \left(u(q_{iz_m}) - p_m q_{iz_m}\right) dz_m \quad (11)$$

$$\begin{aligned} V^* &= W^*(w,w^*,t^*) + L^* \int_0^{N^*} \left(u^*(q_{iz_{n^*}}^*) - p_{n^*}^* q_{iz_{n^*}}^*\right) dz_{n^*} \\ &\quad + L^* \int_0^{M^*} \left(u^*(q_{iz_{m^*}}^*) - p_{m^*}^* q_{iz_{m^*}}^*\right) dz_{m^*}. \end{aligned} \quad (12)$$

In order to evaluate the desirability of import tariffs, observe that from (11):

$$\begin{aligned} \frac{dV}{dt} &= \left(aQ_{n^*}^* + a_o^* Q_{m^*}^*\right) \frac{\partial w}{\partial t} - \left(a^* Q_m + a_o Q_n\right) \frac{\partial w^*}{\partial t} + t \frac{\partial Q_m}{\partial t} \\ &= \mathcal{E}\omega_t - \mathcal{M}\omega_t^* - tML\left(a^*\omega_t^* + a_o^*\omega_t + 1\right)/\gamma, \end{aligned} \quad (13)$$

where $\mathcal{E} \equiv aQ_{n^*}^* + a_o^* Q_{m^*}^*$ and $\mathcal{M} \equiv a_o Q_n + a^* Q_m$ respectively denote the home country labor content of home exports (inclusive of home labor content of goods exports as well as completed offshored tasks) in sector x, and the foreign labor content of home imports (inclusive of goods and tasks imports). The last expression, $t(\partial Q_m/\partial t)$, is the canonical tariff distortion term, which is strictly negative whenever $t > 0$.[17]

Thus, from (13), any home country welfare change subsequent to an import tariff is driven by two effects: (i) a factor content of trade weighted terms of trade effect ($\mathcal{E}\omega_t - \mathcal{M}\omega_t^*$), and (ii) the canonical tariff distortion effect, $t(\partial Q_m/\partial t)$. The former is the analog of the standard terms

[16] Budget balance requires that $W = L\left(q_{iy} + cN(\alpha - c)/\gamma + (c^* + t)M(\alpha - c^* - t)/\gamma\right)$, and $W^* = L^*\left(q_{iy}^* + (c + t^*)N^*(\alpha^* - c - t^*)/\gamma^* + c^*M^*(\alpha^* - c^*)/\gamma^*\right)$.

[17] This follows directly from the proof of Proposition 1 and we demonstrate this in the appendix.

of trade consequences of import tariffs (e.g. Johnson 1953, Bagwell and Staiger 1999) cast in the context of a two-country model of trade with two-way backward and forward linkages.

Analogously in the foreign country, the welfare change associated with an increase in import tariff can be similarly decomposed into a factor content of trade weighted terms of trade term and a tariff distortion term:

$$\begin{aligned}\frac{dV^*}{dt^*} &= (a^*Q_m + a_oQ_n)\frac{\partial w^*}{\partial t^*} - (aQ^*_{n^*} + a^*_oQ^*_{m^*})\frac{\partial w}{\partial t^*} + t^*\frac{\partial Q^*_{n^*}}{\partial t^*} \\ &= \mathcal{E}^*\omega^*_{t^*} - \mathcal{M}^*\omega_{t^*} - t^*N^*L^*\left(a\omega_{t^*} + a_o\omega^*_{t^*} + 1\right)/\gamma^*, \end{aligned} \tag{14}$$

where $\mathcal{E}^* = a^*Q_m + a_oQ_n$ and $\mathcal{M}^* = aQ^*_{n^*} + a^*_oQ^*_{m^*}$ are, respectively, the foreign country labor content of goods and tasks exports from the foreign country, and the home country labor content in goods imports and tasks offshored by the foreign country respectively. As in the home country, foreign tariffs also give rise to a tariff distortion term $t^*Q^*_{n^*}/\partial t^*$. In this two-country setup, market equilibrium requires that $\mathcal{E}^* = \mathcal{M}$ and $\mathcal{M}^* = \mathcal{E}$.

With the help of (13) - (14), we now investigate the nature of optimal trade policy formation in three distinctive settings: (i) the nature and enforcement of the globally first-best import tariffs in the two countries, (ii) the Nash equilibrium tariffs, and (iii) the possibility and limitations of applying labor standards to replicate the jointly optimal first best outcome.

3.2 Enforcing First Best Tariffs

From (13) and (14), we see that deviations from free trade ($t = t^* = 0$) give rise to factor content weighted terms of trade changes that are necessarily zero-sum, since $\mathcal{E}\omega_t - \mathcal{M}\omega^*_t = -\mathcal{E}^*\omega^*_t + \mathcal{M}^*\omega_t$, and $\mathcal{E}^*\omega^*_{t^*} - \mathcal{M}^*\omega_{t^*} = -\mathcal{E}\omega_{t^*} + \mathcal{M}\omega^*_{t^*}$. Import tariffs introduce additional welfare losses due to tariff distortions when $t\partial Q_m/\partial t < 0$ or $t^*\partial Q^*_{n^*}/\partial t^* < 0$ for $t > 0$ and $t^* > 0$.[18] Free trade is thus the first best policy. In order to disincentivize unilateral deviations from first best tariffs, (13) and (14) together suggest that tariff retaliation will have to be severe enough to remove any factor content weighted terms of trade advantages extracted as a consequence of unilateral trade policy violation. This is the essence of the rebalancing role of retaliation enshrined in Article 22.4 of the Dispute Settlement Understanding of the WTO, whereby the allowable level of suspension of concessions subsequent to an infringement should be substantially equivalent to the level of impairment or nullification of market access.[19]

[18] See the appendix for a proof of these comparative statics results.

[19] The literature on the definition of equivalent retaliation is longstanding. See for example Bagwell and Staiger (1999, 2002), Lawrence (2003), and Kohler (2004), for example.

Using (13) and (14), we can pin down the precise level of equivalent retaliatory tariff that eliminates any terms of trade gains extracted via a trade violation by a trade partner.[20] In particular, we are interested in whether a country's position along the supply chain will change the nature and level of retaliation required to mitigate / eliminate incentives to violate a trade agreement. Starting from a first best trade agreement with $t = t^* = 0$, define an equivalent retaliatory home tariff schedule as:

$$t(t^*) = \{\tau | \mathcal{E}^*(0,0)[w^*(\tau, t^*) - w^*(0,0)] - \mathcal{M}^*(0,0)[w(\tau, t^*) - w(0,0)] = 0\}. \tag{15}$$

$t(t^*)$ gives the home import tariff response to a foreign trade violation t^* that eliminates any foreign terms of trade advantages that may have been gained starting from a free trade equilibrium ($t^* = t = 0$). Likewise define an equivalent retaliatory foreign tariff schedule as:

$$t^*(t) = \{\tau^* | \mathcal{E}(0,0)[w(t, \tau^*) - w(0,0)] - \mathcal{M}(0,0)[w^*(t, \tau^*) - w^*(0,0)] = 0\}. \tag{16}$$

$t(t^*)$ and $t^*(t)$ have a number of sensible properties. For example, bilateral free trade is on the retaliatory tariff schedules:

$$t(0) = t^*(0) = 0,$$

as such no country can retaliate by deviating from free trade against a trade partner's adherence to free trade. Second, since $\mathcal{E} = \mathcal{M}^*$ and $\mathcal{M} = \mathcal{E}^*$, the two retaliatory tariffs coincide:

$$t(t^*(\tilde{t})) = \tilde{t} \text{ and } t^*(t(\tilde{t^*})) = \tilde{t^*}$$

Thus, the equivalent retaliatory schedules are internally consistent, in the sense that retaliation by one country in response to a trade agreement violation does not justify another round of retaliation by the first violator. In addition, it can be shown that

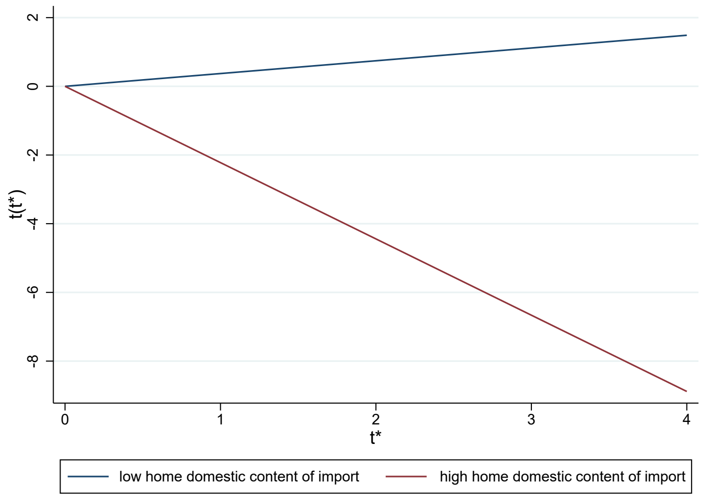
Proposition 2 *Given any foreign trade agreement violation $t^* \neq 0$ that gives rise to an improvement in the factor content of trade weighted terms of trade in the foreign country,*

$$\mathcal{E}^*(0,0)[w^*(0,t^*) - w^*(0,0)] - \mathcal{M}^*(0,0)[w(0,t^*) - w(0,0)] > 0,$$

equivalent retaliation calls for an import tariff $t(t^*) > 0$ if the home domestic content of import θ^* is sufficiently low, and an import subsidy $t(t^*) < 0$ otherwise.

[20]These are retaliatory tariffs that eliminate trade partner incentives to deviate from a trade agreement. Thus, they are, in general, not unilaterally optimal tariffs. We discuss best response tariff schedules in the next subsection.

Figure 3: Equivalent Retaliatory Tariff Schedules ($t(t^*)$)



Proposition (2) showcases a novel form of trade policy asymmetry in the presence of offshoring. Specifically, equivalent retaliation can rule out an eye for an eye type tariff retaliation against a trade partner's tariff, and prescribes an import subsidy instead. To understand this result, note from Proposition 1 that in upstream countries with sufficiently high domestic content of imports, taxing imports lowers wages both locally and abroad. It follows that when local labor content embodied in imports is high, an import tariff can in fact worsen the retaliating country's factor content adjusted terms of trade. Consequently, only an import subsidy, which increases the price of the country's labor content in exports, is able to rebalance any terms of trade gains that a foreign country import tariff may have accomplished.

Of course, import subsidies must be funded, and to the extent that such funding may not be forthcoming, Proposition 2 suggests a possible break down in the ability of countries to leverage the dispute settlement understanding of the WTO to punish countries that violate the first best trade agreement by erecting import tariffs.

To conclude this discussion on equivalent retaliation, we use our general equilibrium closed form solutions to back out the equivalent tariff formula in (15) and (16). In Figure 3, we plot these relationships based on two sets of parameter configurations, in which a baseline of no offshoring ($\theta = \theta^* = 0$) is compared with another regime in which only the home country is the lone upstream country $\theta^* > \theta = 0$. As expected, equivalent tariffs passes though the free trade combination of import tariffs, and changes slope from positive to negative when the domestic content of imports of the home country parameterized by θ^* increases. The full list of parameter values used in the computation of these equivalent tariff schedules are displayed in Table 4.[21]

3.3 Nash Equilibrium Tariffs

When trade agreement fails, equations (13) and (14) respectively define a pair of import tariff best responses, based on which the nature of an all out trade war can be characterized. Specifically, define

$$\bar{t}(t^*) = \{\tau | \mathcal{E}(\tau, t^*)\omega_t - \mathcal{M}(\tau, t^*)\omega_t^* - \tau ML\left(a^*\omega_t + a_o^*\omega_t^* + 1\right)/\gamma = 0\}. \tag{17}$$

Likewise define:

$$\bar{t^*}(t) = \{\tau^* | \mathcal{E}^*(t, \tau^*)\omega_{t^*}^* - \mathcal{M}^*(t, \tau^*)\omega_{t^*} - \tau^* N^* L^*\left(a\omega_{t^*} + a_o\omega_{t^*}^* + 1\right)/\gamma^* = 0\}. \tag{18}$$

$\bar{t}(t^*)$ and $\bar{t^*}(t)$ respectively prescribe the unilaterally optimal import tariff / subsidy levels that balance the terms of trade gains and tariff/subsidy distortions consequences of any deviations from free trade for the home and the foreign countries respectively. From Proposition 1, a home country with sufficiently high domestic content of import will find an import tariff to have less appeal, as the local wage impact of t (ω_t) is negative. By contrast, the foreign country, under the same conditions, may find an import tariff to be more attractive, as a foreign import tariff not only pushes the home wage downwards, the reduction in wage can increase the foreign wage via the productivity effect via (7).

We can nicely demonstrate these tendencies by solving explicitly for $\bar{t}(t^*)$ and $\bar{t^*}(t)$ using the general equilibrium wage solutions in (10).[22] Table 3 displays the best response schedules, $\bar{t}(t^*)$ and $\bar{t^*}(t)$, for successively higher values of θ^*, when $\theta = 0$ throughout. As shown, from low θ^* to high θ^*, the home and foreign best response tariff schedules shift in opposite fashion. The asymmetry is shown through a shifting-in of the home country best response, and a shifting-out of the foreign country best response. The equilibrium Nash policies are likewise asymmetric, showing a reduction in the home tariff, and an increase in the foreign tariff from $(t, t^*) = (2.22, 1.987)$ for a low θ^* Nash equilibrium to $(t, t^*) = (-0.67, 4.128)$ for a high θ^* Nash

[21] Table 3 also shows the corresponding equilibrium wages, which are consistent with the pattern of one-way offshoring in this example, since $\beta^* A^* w - Aw < 0$ and $\beta Aw^* - Aw > 0$ in both cases.

[22] The full lists of parameter values are displayed in Table 4, and the corresponding equilibrium wages, production and trade outcomes are also included.

equilibrium. These are indicated in bold in the Table. Thus, even in a non-cooperative setting, offshoring harbors a pro-trade bias in the upstream home country, and the reverse response in the downstream foreign country.

Of course, these findings presume that an import subsidy is fiscally feasible. Ruling it out for government budget reasons imply constrained best responses $\max\{0, \bar{t}(t^*)\}$ and $\max\{0, \bar{t}^*(t)\}$, and corresponding Nash equilibrium. Clearly, these constraints are not binding for the low θ^* Nash equilibrium, and binding only for the high θ^* Nash equilibrium in the upstream home country. Given these constraints, the Nash equilibrium tariffs are $(t, t^*) = (2.22, 1.98)$ for a low θ^* Nash equilibrium and $(t, t^*) = (0.00, 4.130)$ for a high θ^* Nash equilibrium. A notable feature of these trade war configurations is that if free trade is the optimal policy in an all out trade war, the upstream country has little leverage left to offer to entice the downstream country to sign a free trade agreement starting from a high θ^* Nash equilibrium, where the home country's constrained optimum outcome is free trade.

3.4 Replicating the First Best Equilibrium with Labor Standards

If import subsidies are not feasible to directly enforce the first best agreement due to funding gaps, or if funding constrained Nash equilibrium as a threat point is not sufficient to incentivize trade partners to negotiate a first best agreement, what are some available pathways that can facilitate and sustain multilateral trade agreements in the presence of offshoring ties? In a different setting than ours, where an international holdup problem in input markets applies due to the lock-in effects of costly search, Antràs and Staiger (2012) shows that trade agreements will need to entertain deep integration, in which governments coordinate actions in trade and input market policies. Furthermore, any efficient trade agreement must simultaneously mitigate against incentives for using trade policies to reap terms of trade gains, and reduce the deadweight losses associated with export promotion programs of traded intermediate goods.

While our model does not feature such lock-in effects, our findings agree with Antràs and Staiger (2012) in that cooperation may break down if trade agreements continue to focus exclusively on market access in the presence of offshoring. In what follows, we propose an alternative perspective in conceptualizing policy measures that can help sustain an open trade environment between upstream and downstream countries in the presence of offshoring. Specifically, we seek to illustrate the important role that labor standards can play in trade agreements between economies engaged in offshoring relationships. Consider a pair of minimum labor standards, in the form of minimum wages $\bar{w}$ and $\bar{w}^*$ in the two countries respectively. In doing so, the foreign country is unable to manipulate home wages via the trade tax t^*, and vice versa the home country is not able to manipulate the foreign wage by choice of t . The wage in the rest of the economy continues to be competitively determined at w and w^* to clear the labor market. Denote unit cost of production in the two countries are $\bar{c} = a\bar{w} + a_o\bar{w}^*$ and $\bar{c}^* = a^*\bar{w}^* + a_o^*\bar{w}$, labor market equilibrium requires:

$$L = L_y(w) + L_x(\bar{w}, \bar{w}^*, t, t^*), \tag{19}$$

$$L^* = L_y^*(w^*) + L_x^*(\bar{w}, \bar{w}^*, t, t^*). \tag{20}$$

Well-enforced minimum wages $\bar{w}$ and $\bar{w^*}$ renders home and foreign country workers in x immune from the perverse wage impact of import tariffs t and t^*. Labor market equilibrium in the two countries yields a pair of competitively determined wages w and w^* in the homogeneous goods sector. It can be shown that:

Proposition 3 *In the presence of binding and well-enforced minimum wages $\bar{w}$ and $\bar{w^*}$,*

$$\left.\frac{\partial w}{\partial t}\right|_{\bar{w},\bar{w}^*} \leq 0 \text{ if and only if } a_o^* \geq 0, \quad \frac{\partial w^*}{\partial t} < 0$$

similarly,

$$\left.\frac{\partial w}{\partial t^*}\right|_{\bar{w},\bar{w}^*} < 0, \quad \frac{\partial w^*}{\partial t^*} \leq 0 \text{ if and only if } a_o \geq 0.$$

Intuitively, a home import tariff always depresses foreign labor demand in x through (20), and only depresses home labor demand in x if the domestic content of imports in the home country is strictly positive $a_o^* > 0$. The effect of an import tariff in the foreign country is analogous. These changes in labor demand in x are then absorbed in the homogeneous goods sector y, with corresponding wage consequences as shown in Proposition 3.

The two minimum wages sustain a constant level of factor content of trade weighted terms of trade in the two countries starting from any agreed upon tariffs, since $\mathcal{E}^*(0,0)\bar{w^*} - \mathcal{M}^*(0,0)\bar{w}$ and $\mathcal{E}(0,0)\bar{w} - \mathcal{M}(0,0)\bar{w}^*$ are invariant to changes in the import tariffs as both $\bar{w}$ and $\bar{w}^*$ are both institutionally given. Furthermore, an import tariff can exacerbate the misallocation associated with a minimum wage that is too high, as any reduction in domestic demand (when $a_o^* > 0$, or $a_o > 0$) can render trade policy violation even less attractive. These possibilities are borne out in what follows, which shows using (11) that in the presence of a binding minimum wage $\bar{w^*} \geq \partial Y^*(L_y^*)/\partial L_y^*$,

$$\frac{dV^*}{dt^*} \quad = \quad \left(\bar{w}^* - \frac{\partial Y^*(L_y^*)}{\partial L_y^*}\right) A_y^* \left.\frac{\partial w^*}{\partial t^*}\right|_{\bar{w},\bar{w}^*} - t^* N^* L^*/\gamma^* \leq 0 \tag{21}$$

whenever $t^* \geq 0$. The second term $t^* N^* L^*/\gamma^*$ is the canonical tariff distortion term. The expression $(\bar{w}^* - \partial Y^*(L_y^*)/\partial L_y^*) A_y^* \partial w^*/\partial t^* \leq 0$ is a new tariff distortion term, which applies if the minimum wage is set higher than labor productivity in y. A further increase in the import tariff will only result in an even more inefficient allocation of labor between the two sectors if and only if $a_o > 0$. Thus, international labor standards in the form of minimum wages nullifies the perceived gains from raising import barriers, and in so doing, alters the trade policy preference of the foreign country in favor of free trade.

Analogously in the home country, with a binding minimum wage $\bar{w} \geq \partial Y(L_y)/\partial L_y$ and From (11), we have

$$\frac{dV}{dt} \quad = \quad \left(\bar{w} - \frac{\partial Y^*(L_y^*)}{\partial L_y^*}\right) A_y \left.\frac{\partial w}{\partial t}\right|_{\bar{w},\bar{w}^*} - tML/\gamma \leq 0. \tag{22}$$

for any $t \geq 0$. In summary,

Proposition 4 *With binding minimum wages $\bar{w}$ and $\bar{w}^*$, any unilateral deviation from free trade by either country via import tariffs worsens national welfare.*

This conclusion comes with important caveats. Well-enforced labor standards in the two nations as proposed above (modeled through a binding offshoring sector minimum wage) require deep integration that jointly take into account the efficiency and trade agreement enforcement consequences of trade and labor market policies. For example, the minimum wages will need to be adjusted and set equal to the first best competitive wage to replicate the first best trade benchmark without minimum wages – a tall order given the realities of trade agreement negotiations and trade dispute settlement, such as prolonged negotiation delays. Furthermore, introducing labor standards in trade talks presumes that countries can simultaneously refrain from tendencies to engage in a race to the bottom in labor standards to gain market share amongst upstream countries, in addition to unilaterally protectionistic tendencies via the use of tariffs, wherever applicable.

With these caveats in mind, what we have shown is that labor standards and trade are not always substitutes, in the sense that better labor standards will adversely affect trade flows.

Far from it, our findings suggest that suitably selected and enforced labor standards and trade liberalizing agreements can be complements of one another, where labor standards promote trade by remolding countries' incentives away from unilateral protectionistic moves.

4 Discussion

We showcased above a parsimonious model in which trade policy preference asymmetry in the presence of offshoring ties is brought into sharp relief. The basic model can be extended in multiple ways to incorporate additional salient feature of the countries in question.[23]

Endogenous Offshoring Intensities

So far we have assumed that offshoring intensities θ and θ^* are exogenously given based on technological and offshoring cost considerations. These margins along the task spectrum can be endogenized to depend explicitly on the relative wage considerations in the two countries, for example along the lines of Grossman and Rossi-Hansberg (2008). Doing so would make demand for both home and foreign country workers more responsive to own-wage changes, since a higher labor cost lowers demand for home output, in addition to the endogenous range of task performed locally per unit of output.

Meanwhile, accounting for extensive margin variations along the task spectrum makes demand for both home and foreign country workers less responsive to cross-wage changes. This follows since a higher foreign wage increases labor cost in the home country whenever $a_o > 0$, but the range of tasks performed by home country workers increases per unit output as employers substitute away from using foreign workers in the production. A similar argument can be made for the foreign labor demand elasticity with respect to changes in the home country wage.

Acknowledging these novel labor demand elasticities considerations, endogenous offshoring intensities will not shut down the tendencies for trade policy preference asymmetry brought on by offshoring that we have discussed in this paper. Our conclusion regarding the benefits of labor standards will also stand, since at given minimum wages in the two countries, the set of task offshored will be dictated by relative minimum wages, and thus independent of import tariffs, as we have assumed above.

[23]Details of these extensions are availble from the authors upon request.

Market Power

Since each variety in the heterogeneous goods sector is distinct, our model can readily incorporate market power in the product market, wherein each variety is produced by a single producer who wields price setting power taking at given wage costs w, w^*, and the share of offshorable tasks θ and θ^*. Naturally, market power raises prices and restricts demand. These inefficiencies will come into play when considering optimal trade policy as both a means to extract terms of trade gains, as well as a remedial policy to correct for market imperfections.

In our setup, the first best trade policy in the presence of export monopsonies is a pair of import subsidies, in place to offset the effects of markup pricing and the resulting wedges between production costs and consumer prices. Adding product market power thus changes the nature of the first best policies, but given the markup, the mechanics that drive the asymmetric own-tariff wage responses in upstream and downstream countries as laid out in Proposition 1 remain unchanged. Consequently, unilaterally optimal trade policy preferences will continue to exhibit the kind of asymmetry as shown in Proposition 2 as long as the domestic labor content of imports in the two countries are sufficiently divergent. Furthermore, introducing minimum wages in this setting keeps wage costs immune from manipulation by import protection. In the current setup, well enforced labor standards can continue to play an integral part in mitigating the terms of trade motives behind trade agreement violations.

Cross-Price Elasiticity of Demand

Finally, we have so far maintained the assumption of additively separable utility as in Antràs and Staiger (2012) in order to single out a product variety's labor and trade costs as the primary determinants of labor demand in the two countries. A more general setting can also incorporate consumption demand effects that arise in the presence of substitution possibilities across varieties (e.g. Melitz and Ottaviano 2008).

These substitution effects can also be applied to understand the workings of tariffs in the presence of offshoring. Consider once again a home import tariff when there is domestic content embodied in imports. The import tariff motivates consumers to substitute away from imports in favor of local varieties. The resulting increase in demand for labor employed in local varieties can offset the negative effects of the tariff on home workers employed to complete offshored tasks used in imports. The takeaway message here is that cross-substitution possibilities add nuance to our findings, and in particular, own-tariff wage responses will continue to be negative in upstream countries provided that the domestic content of imports is high, *and* that the cross-price demand elasticity substitution effects are mild.

5 Conclusion

Offshoring has become an indispensable feature of the global trading system. Governments in both offshoring countries and offshoring destinations face new challenges in setting rules to facilitate and sustain efficient and mutually beneficial trade agreements. We have shown that offshoring arrangements create an asymmetry where downstream nations are more incentivized to depart from free trade agreements by restricting imports, but for more upstream countries, a more pro-trade stance applies. Furthermore, the upstream nation may not be able to retaliate using a tariff without resulting in self-inflicted welfare losses. While it is conceivable that side payments can keep the downstream nation from violating the trade agreement, trade agreement violations can occur if side payments fall short. Consistent with this possibility, in Tables 1 and 2) we observe that trade partners with an offshoring relationship are more likely to engage in trade disputes where the dispute complainant has relatively higher domestic content share of imports from the dispute respondent.

In addition, the advent of international offshoring provides fertile grounds for revisiting long held assumptions about the role of labor standards in global trade. In particular, the effectiveness of labor standards to advance the interest of workers has been previously challenged on the grounds that such standards chase employers away, thus robbing upstream country labor markets of their main source of advantage. In this paper, we shed new light on the role of labor standards, and show that when workers' wages are protected by minimum wages set appropriately to reflect first best labor productivity, both countries can in fact be incentivized to remain faithful to the terms of a trade agreement. From this broader perspective of how mutually acknowledged labor standards can play an important role in the signing of trade agreements, labor standards facilitate trade liberalization and as well as the benefits thereof to workers. Indeed, recent trade agreements have made strides towards incorporating labor standards, including the Trans-Pacific Partnership (TPP) and the Trans-Atlantic Trade and Investment Partnership (TTIP). Our paper provides a possible rationale rooted in the trade policy preference asymmetries that can potentially arise when countries in trade agreements are linked via extensive offshoring relationships.

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Table 1: Summary of Statistics (N= 102960; 1995-2018)

	(1)	(2)	(3)	(4)	(5)	(6)
	Pooled	1%	3%	5%	7%	10%
Contentdum=1						
Trade Dispute Incidence						
mean		0.0117	0.0124	0.0145	0.0278	0.0857
sd		0.1074	0.1106	0.1196	0.1647	0.2809
Domestic Content Share (%)						
mean		2.5208	5.5631	7.7856	9.5614	12.7330
sd		2.1257	2.7294	2.7366	2.7432	3.0365
Observations		9077	2020	897	467	140
Contentdum=0						
Trade Dispute Incidence						
mean		0.0016	0.0022	0.0023	0.0023	0.0023
sd		0.0394	0.0474	0.0483	0.0482	0.0483
Domestic Content Share (%)						
mean		0.1504	0.2552	0.2941	0.3174	0.3425
sd		0.2048	0.4520	0.5843	0.6860	0.8175
Observations		93983	100940	102063	102493	102820
Trade Dispute Incidence						
mean	0.0024					
sd	0.0494					
Domestic Content Share (%)						
mean	0.3594					
sd	0.9425					
Observations	102960					

Data source: OECD TiVA Database.

Table 2: Determinants of Importer Launched Trade Disputes (1995-2018), Linear Probability Model

	(1) tradedispute	(2) tradedispute	(3) tradedispute	(4) tradedispute	(5) tradedispute	(6) tradedispute
Domestic Content Sh.	0.0033***	0.0033***	0.0033***	0.0028*	0.0030*	0.0030*
	(0.0008)	(0.0009)	(0.0009)	(0.0014)	(0.0016)	(0.0016)
Observations	102960	102960	102960	102960	102960	102960
Importer FE	Yes	Yes	No	Yes	Yes	No
Exporter FE	Yes	Yes	No	Yes	Yes	No
Pair FE	No	No	Yes	No	No	Yes
Importer Manu. Prod	No	Yes	Yes	No	Yes	Yes
Exporter Manu. Prod.	No	No	Yes	No	No	Yes
R2	0.0377	0.0377	0.0380	0.1765	0.1765	0.1768

Notes. 1. This table presents estimates from a linear probability model of the likelihood of an importer launched WTO trade dispute with robust standard errors and two-way fixed effects. 2. For each importer-exporter pair × year observation, the dependent variable takes on a value of 1 if the importer launched a trade dispute against the exporter in year t. 3. The "Domestic Content Sh." variable is defined as the domestic content of imports of j from i as a share of the value of total imports of j from i averaged across industries in year t. 4. Robust standard errors are in parentheses. 5. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Equivalent Retaliatory Tariff Schedules

Home Best Response $t(t^*)$			**Foreign Best Response** $t^*(t)$		
t^*	$t(t^*)$ low θ^*	$t(t^*)$ high θ^*	t	$t^*(t)$ low θ^*	$t^*(t)$ high θ^*
0	2.2171	-0.7610	-1	1.9892	4.1269
0.25	2.2180	-0.7558	-0.75	1.9890	**4.1277**
0.5	2.2190	-0.7506	-0.5	1.9889	**4.1285**
0.75	2.2199	-0.7453	-0.25	1.9887	4.1292
1	2.2209	-0.7401	0	1.9886	4.1300
1.25	2.2218	-0.7349	0.25	1.9884	4.1308
1.5	2.2228	-0.7296	0.5	1.9882	4.1316
1.75	**2.2237**	-0.7244	0.75	1.9881	4.1324
2	**2.2247**	-0.7192	1	1.9879	4.1332
2.25	2.2256	-0.7139	1.25	1.9878	4.1340
2.5	2.2266	-0.7087	1.5	1.9876	4.1347
2.75	2.2276	-0.7035	1.75	1.9874	4.1355
3	2.2285	-0.6982	2	**1.9873**	4.1363
3.25	2.2295	-0.6930	2.25	**1.9871**	4.1371
3.5	2.2304	-0.6878	2.5	1.9870	4.1379
3.75	2.2314	-0.6825	2.75	1.9868	4.1387
4	2.2323	**- 0.6773**	3	1.9866	4.1394
4.25	2.2333	**-0.6721**	3.25	1.9865	4.1402
4.5	2.2342	-0.6668	3.5	1.9863	4.1410
4.75	2.2352	-0.6616	3.75	1.9862	4.1418
5	2.2361	-0.6564	4	1.9860	4.1426
5.25	2.2371	-0.6511	4.25	1.9858	4.1434
5.5	2.2380	-0.6459	4.5	1.9857	4.1442
5.75	2.2390	-0.6407	4.75	1.9855	4.1449
6	2.2399	-0.6354	5	1.9854	4.1457

[1] This table presents two sets of simulated equivalent tariff best response schedules defined in equations (15) and (16). [2] The model parameter values for the high and low tariff regimes are displayed in Table 4.

Table 4: Calibrated Model Parameters and Solutions

Model Parameters

Home		**Foreign**		
			low θ^*	high θ^*
A	1.0	A^*	1.0	1.0
θ	0.0	θ^*	0.1	0.5
β	0.9	β^*	1.1	1.1
L	100.0	L^*	100.0	100.0
γ	2.0	γ^*	1.0	1.0
α	30.0	α^*	30.0	30.0
A_y	300.0	A_y^*	200.0	200.0
N	1	M	5	5
N^*	1	M^*	5	5
$\bar{L}_y$	300.0	$\bar{L}_y^*$	300.0	300.0

Model Solutions with Free Trade

w			3.2	7.0
w^*			11.5	7.7

[1] This table presents the list of parameter values adopted for the calibrated model.
[2] The model wage solutions under free trade are also displayed, showing higher wages in the foreign country throughout, consistent with one-way offshoring $\theta = 0$ and $\theta^* > 0$.

Appendix A

Existence, Uniqueness, and Proof of Proposition 1:

We proof the existence and uniqueness of the general equilibrium wage pair (w, w^*) by construction. Labor market equilibrium in the two countries requires

$$L = L_y(w) + L_x(w, w^*, t, t^*), \tag{23}$$

$$L^* = L_y^*(w^*) + L_x^*(w, w^*, t, t^*) \tag{24}$$

where in the homogeneous goods sector y,

$$L_y(w) = \bar{L}_y - A_y w, \quad L_y^*(w^*) = \bar{L}_y^* - A_y^* w^*.$$

In addition, in the heterogeneous goods sector x,

$$L_x(w, w^*, t, t^*) = a\left(Q_n(w, w^*) + Q_{n^*}^*(w, w^*, t^*)\right) + a_o^*\left(Q_m(w, w^*, t) + Q_{m^*}^*(w, w^*)\right)$$

and

$$L_x^*(w, w, t, t^*) = a^*\left(Q_m(w, w^*, t) + Q_{m^*}^*(w, w^*)\right) + a_o\left(Q_n(w, w^*) + Q_{n^*}^*(w, w^*, t^*)\right)$$

where

$$Q_n(w, w^*) = NL(\alpha - aw - a_o w^*)/\gamma, \qquad Q_m(w, w^*, t) = ML(\alpha - a^* w^* - a_o^* w - t)/\gamma,$$

$$Q_{n^*}^*(w, w^*, t^*) = N^* L^*(\alpha^* - aw - a_o w^* - t^*)/\gamma^*, \qquad Q_{m^*}^*(w, w^*) = M^* L^*(\alpha^* - a^* w^* - a_o^* w)/\gamma^*$$

Denote labor demand shifters in sector x of the two countries as

$$\bar{L}_x \equiv (aN + a_o^* M)\alpha L/\gamma + (aN^* + a_o^* M^*)\alpha^* L^*/\gamma^*,$$

$$\bar{L}_x^* \equiv (a_o N + a^* M)\alpha L/\gamma + (a_o N^* + a^* M^*)\alpha^* L^*/\gamma^*.$$

Also denote economy-wide normalized labor demand shifters in the two countries as:

$$\mathcal{L} = (\bar{L}_x + \bar{L}_y - L)\left(\frac{NL}{\gamma} + \frac{N^* L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^* L^*}{\gamma^*}\right)^{-1}$$

$$\mathcal{L}^* = (\bar{L}_x^* + \bar{L}_y^* - L^*)\left(\frac{NL}{\gamma} + \frac{N^* L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^* L^*}{\gamma^*}\right)^{-1}$$

Let s_p and $1 - s_p$ respectively be production share parameters of the home and the foreign country:

$$s_p = (\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*}) \left(\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^*L^*}{\gamma^*} \right)^{-1}.$$

Also let σ_m and σ_{n^*} respectively be import share parameters of the home and the foreign country:

$$\sigma_m = \frac{ML}{\gamma} \left(\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^*L^*}{\gamma^*} \right)^{-1}, \ \sigma^*_{n^*} = \frac{N^*L^*}{\gamma^*} \left(\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^*L^*}{\gamma^*} \right)^{-1}.$$

In addition, let

$$\begin{aligned} a_y &\equiv A_y \left(\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^*L^*}{\gamma^*} \right)^{-1} \\ a^*_y &\equiv A^*_y \left(\frac{NL}{\gamma} + \frac{N^*L^*}{\gamma^*} + \frac{ML}{\gamma} + \frac{M^*L^*}{\gamma^*} \right)^{-1}. \end{aligned}$$

In equilibrium, the two wages w and w^* simultaneously solve (8) and (9), with unique closed-form solutions:

$$\begin{aligned} w(t, t^*) &= \omega_o + \omega_t t + \omega_{t^*} t^*, \\ w^*(t, t^*) &= \omega^*_o + \omega^*_t t + \omega^*_{t^*} t^* \end{aligned}$$

where

$$\begin{aligned} \omega_o &= \left(\mathcal{L}(a^*_y + (a^*)^2(1 - s_p) + (a_o)^2 s_p) - \mathcal{L}^*(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \omega^*_o &= \left(\mathcal{L}^*(a_y + (a)^2 s_p + (a^*_o)^2(1 - s_p)) - \mathcal{L}(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \omega_t &= -\sigma_m \left(a^*_o(a^*_y + (a^*)^2(1 - s_p) + (a_o)^2 s_p) - a^*(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \omega^*_t &= -\sigma_m \left(a^*(a_y + (a)^2 s_p + (a^*_o)^2(1 - s_p)) - a^*_o(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \omega_{t^*} &= -\sigma^*_{n^*} \left(a(a^*_y + (a^*)^2(1 - s_p) + (a_o)^2 s_p) - a_o(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \omega^*_{t^*} &= -\sigma^*_{n^*} \left(a_o(a_y + (a)^2 s_p + (a^*_o)^2(1 - s_p)) - a(a a_o s_p + a^* a^*_o(1 - s_p)) \right) / \Omega \\ \Omega &= a_y a^* y + a_y((a^*)^2(1 - s_p) + (a_o)^2 s_p) + a^*_y((a)^2 s_p + (a^*_o)^2(1 - s_p)) \\ &\quad + s_p(1 - s_p)(a a^* - a_o a^*_o)^2 > 0. \end{aligned}$$

Thus, at $t = t^* = 0$, $w > 0$ and $w^* > 0$ if and only if the two country's overall labor demand are not too divergent so no country is completely specialized in x, or

$$\frac{a^*_y + (a^*)^2(1 - s_p) + (a_o)^2 s_p}{a a_o s_p + a^* a^*_o(1 - s_p)} > \frac{\mathcal{L}^*}{\mathcal{L}} > \frac{a a_o s_p + a^* a^*_o(1 - s_p)}{a_y + (a)^2 s_p + (a^*_o)^2(1 - s_p))}.$$

Own-tariff wage effect in the home country is positive if and only if $\omega_t < 0$,or

$$\frac{a_o^*}{a^*} > \frac{a_o}{a}\left(\frac{a^2}{a^*y + s_p a_o^2}\right),$$

while $\omega_{t^*}^* > 0$ in the foreign country if and only if

$$\frac{a_o}{a} < \frac{a_o^*}{a^*}\left(\frac{(a^*)^2}{a_y + (1-s_p)a_o^*)^2}\right).$$

as stated in Proposition 1. Cross-tariff wage effects in both countries are negative since:

$$\begin{aligned}
\omega_t^* &= -\sigma_m \left(a^* a_y + a s_p (a^* a - a_o^* a_o)\right)/\Omega < 0 \\
\omega_{t^*} &= -\sigma_{n^*}^* \left(a a_y^* + a^*(1-s_p)(a a^* - a_o a_o^*)\right)/\Omega < 0
\end{aligned}$$

where $aa^* - a_o a_o^* = AA^*(1-\theta)(1-\theta^*) - AA^*\beta\beta^*\theta\theta^* > AA^*(1-\theta-\theta) > 0$. This inequality follows since $\beta^*\beta < 1$ and $\theta^* < 1-\theta$, or $1-\theta-\theta^* > 0$ by assumption.

Proof of Proposition 2:

Using (15),

$$\frac{\partial t(t^*)}{\partial t^*} = \frac{\mathcal{E}^*(0,0)\omega_{t^*}^* - \mathcal{M}^*(0,0)\omega_{t^*}}{\mathcal{E}^*(0,0)\omega_t^* - \mathcal{M}^*(0,0)\omega_t} = \frac{\mathcal{E}^*(0,0)\omega_{t^*}^* - \mathcal{M}^*(0,0)\omega_{t^*}}{\mathcal{E}(0,0)\omega_t - \mathcal{M}(0,0)\omega_t^*}$$

which follows since $\mathcal{E} = \mathcal{M}^*$ and $\mathcal{M} = \mathcal{E}^*$ in this two-country setup. Suppose that a_o is sufficiently low satisfying the condition under which $\omega_{t^*}^* > 0$ from Proposition 1. It follows that

$$\mathcal{E}^*(0,0)\omega_{t^*}^* - \mathcal{M}^*(0,0)\omega_{t^*} > 0.$$

Furthermore, note that

$$\begin{aligned}
\omega_t &= -\sigma_m \left(a_o^* a_y^* + a_o s_p (a_o^* a_o - a^* a)\right)/\Omega \\
\omega_t^* &= -\sigma_m \left(a^* a_y + a s_p (a^* a - a_o^* a_o)\right)/\Omega
\end{aligned}$$

Suppose that a_o^* is sufficiently high satisfying the condition under which $\omega_t \leq 0$ according to Proposition 1. It follows that evaluated at a_o^* such that $\omega_t = 0$,

$$\mathcal{E}(0,0)\omega_t - \mathcal{M}(0,0)\omega_t^* > 0$$

since $\omega_t = 0$ and $\omega^* t < 0$. However as $\theta^* \to 1$,

$$\mathcal{E}(0,0)\omega_t - \mathcal{M}(0,0)\omega_t^* < 0$$

since $\omega_t < 0$ while $\omega_t^* \geq 0$. It follows that there exists θ^* large enough satisfying the condition in Proposition 1 that $\mathcal{E}(0,0)\omega_t - \mathcal{M}(0,0)\omega_t^* \leq= 0$. It also follows that there exists θ^* large enough such that

$$\frac{\partial t(t^*)}{\partial t^*} = \frac{\mathcal{E}^*(0,0)\omega_{t^*}^* - \mathcal{M}^*(0,0)\omega_{t^*}}{\mathcal{E}(0,0)\omega_t - \mathcal{M}(0,0)\omega_t^*} < 0$$

as stated in Proposition 2. Under these conditions, the schedule of equivalent tariff retaliation is downward sloping, wherein the home country punishes violators with an import subsidy.