

The Offshoring, Labor Standard, and Trade Agreement Nexus

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Abstract: Technological advance and improvements in communication technologies have facilitated the offshoring of jobs worldwide, where a typical scene following the supply chain involves developing countries importing finished products from developed countries that contain developing country labor content. Offshoring thus gives rise to a novel market-level interdependence between developing countries' exports of labor services to, and their imports of final goods from developed countries. In this paper, we demonstrate that such interdependencies introduce a fundamental general equilibrium asymmetry between developed and developing countries in terms of their (i) incentives to violate trade agreements, and (ii) ability to leverage the dispute settlement procedures to punish violators. We then show that a well-enforced set of labor standards in developing countries, such as a binding minimum wage, resolves this conundrum by reviving the ability of the developing countries to use countervailing tariffs to punish trade agreement violators.

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1 Introduction

Offshoring is an ubiquitous feature of global production and international trade. Reduction in trade barriers, technological change in information and communication and technologies have made possible the routinization of tasks and vast improvements in business-to-business coordination across long distances. These factors have contributed to a drastic reduction in the cost of trade fragmentation facilitated by the offshoring of tasks worldwide. 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 (OECD 2009). Johnson and Noguera (2012) found that as high as two-thirds of total merchandise imports for many OECD countries comprised of imported intermediate goods.¹

The growth in offshoring relationships along the global supply chain precipitates a novel type of interdependence between offshoring partners, hitherto underappreciated in a growing literature on offshoring. To wit, developing countries export offshored labor services to developed countries, only to import final products from developed countries that contain their own countries' labor content.

Using OECD data on Trade in Value Added, Table 1 summarizes the domestic content of manufacturing imports across 63 countries from 2005 to 2015, which measures the domestic value added embodied in gross imports from exporting trade partners divided by total gross imports of the exporting country. As such, these figures show the extent to which exported domestic value-added returns to the country in the form of imports from other countries. These relatively unchanging averages conceal important changes at the country level. To see this, we take the mean long difference in the domestic content of manufacturing import by importing country between 2005 and 2015 across trading partners, and regress the change against the initial log scale of manufacturing production in 2005. Figure 1 displays the results of a simple least square regression, and which shows

¹Of 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.

very clearly a negative and significant relationship. Thus, 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.

With this rise in domestic content of imports facilitated by the global value chain, the offshoring relationship shifts the burden of commercial policies to workers in emerging markets in nuanced ways. Specifically, a tax on imports by developing country can now implicitly tax the use of workers in the domestic export sector, for the services of these workers are embodied in imports through trade in intermediate goods, for example. Meanwhile, a tax on imports by developed country is a direct tax on the use of developing country workers as well in the standard way. What are the implications of this interdependence between developing country labor market and developed country export market on optimal policy-making with respect to labor and trade? 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?²

We consider therefore the effects of a trade dispute between a developed and a developing nation who have a trading as well as an offshoring relationship. According GATT Article XXVIII and 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 re-balancing, leaving total 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 trade model that justified these features of a trade agreement is a trade in final goods model, where the salient features of

²A prime and recent example is the US-China trade disputes that began in 2018. The first list of tariffs proposed by the US included 1,333 products, of which intermediate inputs and capital equipment comprised close to 85% of the \$50 billion of imports subject to proposed import tariff (Lovely and Liang 2018, Bown 2018). Subsequently, China retaliated by announcing a list of US exports facing Chinese tariffs, including not just food and materials imports, but also electronics including televisions, cell phones, machinery, vehicles, medical instruments, plastic products for example that worth \$75 billion.

economies engaged in offshoring relationships are not accounted for. The only exception is Antras and Staiger (2012). This paper studies a setting where a hold-up problem 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 holdup issue, and focuses instead on the role of developing country labor market institutions in the offshoring story. Specifically, we propose a canonical model of trade in tasks following the task-based model of the labor market in (Grossman and Rossi-Hansberg 2008). We work with a setting where some production tasks for one of the goods is offshored by the developed nation to the developing nation. The developed nation imposes an offshoring tax, and the developing nation retaliates by using an import tariff. We show that while the offshoring tax leads to partial reversal of offshoring, it also improves the developed nation factor market terms-of-trade by depressing the developing nation wages. On the other hand, it is possible that a developing nation tariff is detrimental as it reduces the demand for labor in the developing country, and giving rise to an adverse terms of trade effect for the developing country.

The insight that ensues is thus that offshoring introduces interdependence between trading partners that (i) enhances the incentives on the part of the developed nation to violate a free trade agreement, while it (ii) constrains the ability of the developing nation to retaliate in response to a developed country tariff. We show this by taking up the dispute settlement reciprocity clause of the WTO (Bagwell and Staiger 2012), which provide guidance on how countries should retaliate against tariff violations. We show that in the presence of an offshoring relationship, there are situations where retaliation by the developing nation may in fact make the developing country worse off. Without effective retaliation that are time consistent in the punishment phase, a trade agreement with dispute settlement reciprocity cannot prevent trade wars.

We propose a potential remedy. The idea is to set up labor market institutions

and policy measures ensure a stable level of factor market terms of trade. These policy measures, we show, are double-edged swords, as they can tame developed countries' incentives to violate trade agreements in order to reap developing country wage benefits. They can also render retaliation in response to any developed country attempts to violate trade agreement beneficial after the violation, and thus time consistent. We demonstrate these ideas using a well-enforced, and binding minimum wage as a potential candidate. Naturally, perfect enforcement is a tall order. Likewise, a two-country world is a far cry from reality. We turn to a series of extension of the basic model where we examine the scope for labor standards to contribute, rather than deter, offshoring relationships between countries.

2 Related Literature

This paper is related to a growing volume of studies on offshoring which 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. Mankiw and Swagel (2006) more specifically examines employment levels in the overseas affiliates of US multinational firms and the US parent. Harrison and McMillan (2011) points to the need for a more nuanced look at the offshoring and employment relationships, by pointing out the need to distinguish between horizontal and vertical foreign investment, while Ottaviano, Peri and Wright (2013) additionally shows that along the spectrum of tasks organized by degree of complexity, offshoring competes with both immigrant workers as well as native workers in the United States. Mitra and Ranjan (2010) introduces search friction into the Grossman and Rossi-Hansberg setting, and Ranjan (2013) demonstrates the importance of labor market institutions such as the employer-employee bargaining relationship. Hummels, Munch and Xiang (2016) is an excellent survey of the literature. In this paper, we contribute to this line of studies by adding the impact of offshoring relationship to trade policy setting as an additional wage consequence associated with offshoring.

Most of this literature has been focussed on developed countries. Two exceptions

are Feenstra and Hanson (1996, 1997), where 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 interestingly 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. (2019) formulates a basic model of tasks offshoring as in Grossman and Rossi-Hansberg (2008), and show that even in this simplest setting, a developing country wage increase when offshoring cost declines is not a guaranteed proposition, and depends instead on general equilibrium labor demand elasticities in the two countries. This paper contributes this literature by pointing out that wages in the developing country in the presence of offshoring is ultimately the outcome of labor market institutions and trade policy interactions between developed and developing country. Furthermore, we show that labor market policies can in fact alter governments' ability to abide by the terms of a free trade agreement.

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 regulations regarding labor standards deters free participation and competition in the global economy (Collier and Dollar 2002), while other studies have shown it is globalization that unleashes a race to manipulate labor standards (Chau and Kanbur 2006, Olney 2013). Despite these concerns, Rodrik (1996), Bhakshi 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 harms exports. Our paper contributes 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. Our findings

sheds light on an empirical literature that has so far been met with confounding answers, and suggest the presence of offshoring as a critical component of a more nuanced understanding.

3 A Two-Country Model of Offshoring

Consider a two-country (developed (F) and developing (H)) setting in which two goods, respectively x and y , are produced. There are \mathcal{L}^* and \mathcal{L} number of workers in the two countries. Their consumption preferences with respect to the two goods (c_x, c_y) are represented by:

$$U(c_y, c_x) = c_y + u(c_x),$$

where $u(\cdot)$ is continuously differentiable, increasing and strictly concave. We take y as the numeraire. p^* and p denote the price of x in F and H respectively. The indirect utility functions at national income levels Y^* and Y are given by:

$$V(Y^*, p^*) = Y^* + \Psi(p^*), \quad V(Y, p) = Y + \Psi(p)$$

where $\Psi(p^*) = u(c_x(p^*)) - p^*c_x(p^*)$, and analogously in H . $c_x(\cdot)$ denotes Marshallian demand of x .

Production technologies in y , $G_y^*(L_y^*)$ and $G_y(L_y)$ respectively in F and H , employ labor only, with strictly diminishing marginal returns. Let $L_y^*(w^*) = \{L_y^* | \partial G_y^*(L_y^*) / \partial L_y^* = w^*\}$ and $L_y(w) = \{L_y | \partial G_y(L_y) / \partial L_y = w\}$ denote the corresponding labor demand schedules at wages w^* and w .

Production of a unit of x requires a continuum of labor tasks $i \in [0, 1]$ to be performed. Producers of x belong in F . They allocate production tasks between the two countries depending on the two wage rates and any other trade and offshoring costs that may apply. We denote i as the complexity of a task. Offshoring a task i from F to H requires a cost of $\beta t(i) > 1$ of the developing nation's labor, where β parameterizes the cost of offshoring. Assume henceforth that $t(i)$ is monotonically increasing in i .

The two countries have at their disposal trade taxes τ^* and τ . τ^* denotes the developed country ad valorem import tax on developing country imports of completed

tasks. Likewise, the developing nation can impose a tax on developed country exports of good x at the ad valorem rate $1 + \tau$.

Accounting for both wage costs and trade taxes, a marginal task I can be defined such that:

$$w^* = w(1 + \tau^*)\beta t(I) \Leftrightarrow t(I) = \frac{w^*}{w(1 + \tau^*)\beta}$$

where $\rho \equiv w^*/(w(1 + \tau^*))$ denotes the relative wage cost between the two countries. By monotonicity of $t(i)$, tasks $i \in (I, 1]$ are conducted in the developed nation, while $i \in [0, I]$ are offshored to the developing nation. Thus, total employment in x is simply $L_x^* = x^*(1 - I)$ in F and $L_x = x^*\beta \int_0^I t(i)di$ in H . Define

$$\lambda = \frac{L_x}{L_x^*} = \frac{\beta \int_0^I t(i)di}{1 - I} \quad (1)$$

as the offshoring intensity in x and let ϵ denote the elasticity of the offshoring intensity with respect to relative wage cost ρ : $\epsilon = d \log \lambda / d \log \rho$.

Full employment in the developed and developing nations implies that:

$$L^*(w^*) = x^*(1 - I), \quad (2)$$

$$L(w) = x^*\beta \int_0^I t(i)di \quad (3)$$

where $L^*(w^*) \equiv \mathcal{L}^* - L_y^*(w^*)$ and $L(w) \equiv \mathcal{L} - L_y(w)$ respectively denote effective labor supply to x in the two countries. Henceforth, let η^* and η , both positive, respectively denote the elasticity of $L^*(w^*)$ and $L(w)$. Using (2) and (3), the full employment conditions in the two countries can be succinctly summarized as follows:

$$\lambda L^*(w^*) = L(w) \quad (4)$$

Henceforth, denote a $\hat{\cdot}$ as proportionate change ($\hat{w} = dw/w$; $\hat{\tau}^* = d\tau^*/(1 + \tau^*)$; $\hat{\tau} = d\tau/(1 + \tau)$). (4) defines the global labor market equilibrium, where

$$(\eta^* + \epsilon)\hat{w}^* - (\eta + \epsilon)\hat{w} = \epsilon\hat{\tau}^*. \quad (5)$$

Next, zero profit in the production of x^* requires:

$$w^*(1 - I) + w(1 + \tau^*)\beta \int_0^I t(i)di = p^*. \quad (6)$$

Denote $\theta^* = w^*(1 - I)/p^*$ as the developed country share of the total labor cost in the production of x^* , we have, upon totally differentiating (6),

$$\theta^* \hat{w}^* + (1 - \theta^*) \hat{w} = \hat{p}^* - (1 - \theta^*) \hat{\tau}^*. \quad (7)$$

For any given world price p^* , (5) and (7) together can be used to solve for wages in the developed and developing countries:

$$\hat{w}^* = \frac{(\eta + \epsilon) \hat{p}^* - \eta(1 - \theta^*) \hat{\tau}^*}{\theta^*(\eta + \epsilon) + (1 - \theta^*)(\eta^* + \epsilon)}, \quad (8)$$

$$\hat{w} = \frac{(\eta^* + \epsilon) \hat{p}^* - (\eta^*(1 - \theta^*) + \epsilon) \hat{\tau}^*}{\theta^*(\eta + \epsilon) + (1 - \theta^*)(\eta^* + \epsilon)}. \quad (9)$$

Thus, an increase in p^* contributes to raising the demand for labor in x in both countries, and consequently both w and w^* rise with p^* . By contrast, an increase in the ad valorem tax τ^* has the opposite effect and decreases w and w^* instead. Finally, global product market equilibrium requires:

$$\mathcal{L}c_x(p^*(1 + \tau)) + \mathcal{L}^*c_x(p^*) = x^*(p^*, \tau^*), \quad (10)$$

where total output $x(p^*, \tau^*)$ is defined implicitly from (2), with $x(p^*, \tau^*) = L^*(w^*)/(1 - I)$. Using (8) and (9), it is straightforward to confirm that the own price elasticity of the general equilibrium supply schedule of $x(p^*, \tau^*)$ is positive:

$$e_{xp}^* \equiv \frac{d \log x^*}{d \log p^*} = \frac{\eta \eta^* + \epsilon \eta / (1 + \pi) + \epsilon \eta^* \pi / (1 + \pi)}{\epsilon + \eta^*(1 - \theta^*) + \eta \theta^*} > 0$$

where $\pi = t(I)(1 - I) / \int_0^I t(i) di > 0$. By contrast, an increase in the import tax τ^* of offshored tasks decreases supply:

$$e_{x\tau^*}^* \equiv \frac{d \log x^*}{d \log \tau^*} = -\frac{\eta(\eta^*(1 - \theta^*) + \epsilon)}{\epsilon + \eta^*(1 - \theta^*) + \eta \theta^*} < 0.$$

Finally, denote $e_c = -d \log c_x / d \log p$ and $e_c^* = -d \log c_x^* / d \log p^*$ as the own price demand elasticities of x in the two countries and $e_{xp}^* = d \log x(p^*, \tau^*) / d \log p^*$, and $e_{x\tau^*}^* = -d \log x(p^*, \tau^*) / d \log \tau^*$ as the supply elasticities, we have from (10),

$$\hat{p}^* = \frac{-(1 - s^*)e_c \hat{\tau} - e_{x\tau^*}^* \hat{\tau}^*}{s^* e_c^* + (1 - s^*)e_c + e_{xp}^*}, \quad (11)$$

where s^* denotes the developed country consumption share $\mathcal{L}^*c_x(p^*)/x(p^*)$.

We are now in a position to examine the general equilibrium impacts of the two import tax rates τ and τ^* on the price of developed country exports p^* and the price of developing country exports w :³

Proposition 1 *An increase in the developed country import tax τ^* increases the price of the developed country export (p^*), and depresses the price of the developing country export (w). An increase in the developing country import tax τ has a negative impact on both p^* and w .*

Proposition 1 illustrates a fundamental asymmetry in policy effectiveness in the presence of offshoring.⁴ A developed country import tax τ^* restricts demand for developing country export of labor services offshored by the developed country, and limits the overall supply of x^* . Thus, the price of offshored labor tasks decreases, while the price of developed country export p^* increases. However, an import tax by the developing country limits demand for developed country export, and in doing so, it also limits developed country's demand for offshored labor services. Thus, while a developing country import

³The results for p^* follow from (11). As for w , substitute (11) into (9). The negative relationship between w and τ is immediate:

$$\frac{\hat{w}}{\hat{\tau}} = -\frac{(1-s^*)e_c(\eta^* + \epsilon)}{(s^*e_c^* + (1-s^*)e_c + e_{xp}^*)(\theta^*(\eta + \epsilon) + (1-\theta^*)(\eta^* + \epsilon))}.$$

Furthermore, routine algebra confirms that developing country wage elasticity with respect to τ^* is negative:

$$\frac{\hat{w}}{\hat{\tau}^*} = -\frac{\epsilon\eta^*\pi((\eta^* + \epsilon)(1-\theta^*) + (\eta + \epsilon)\theta^*)/(1+\pi) + (\eta^*(1-\theta^*) + \epsilon)(s^*e_c^* + (1-s^*)e_c)}{(s^*e_c^* + (1-s^*)e_c + e_{xp}^*)(\theta^*(\eta + \epsilon) + (1-\theta^*)(\eta^* + \epsilon))} < 0.$$

⁴The relationship between w^* and the two tax rates can be similarly derived. Using (8) and (11):

$$\frac{\hat{w}^*}{\hat{\tau}} = -\frac{(1-s^*)e_c(\eta + \epsilon)}{(s^*e_c^* + (1-s^*)e_c + e_{xp}^*)(\theta^*(\eta + \epsilon) + (1-\theta^*)(\eta^* + \epsilon))}.$$

Since an increase in τ^* raises p^* , the developed country wage elasticity with respect to τ^* may be positive or negative:

$$\frac{\hat{w}^*}{\hat{\tau}^*} = -\frac{(\eta + \epsilon)e_{x\tau^*}^* + \eta(1-\theta^*) + \epsilon)(s^*e_c^* + (1-s^*)e_c + e_{xp}^*)}{(s^*e_c^* + (1-s^*)e_c + e_{xp}^*)(\theta^*(\eta + \epsilon) + (1-\theta^*)(\eta^* + \epsilon))}.$$

tax can lower the price of developed country export, this comes at the cost of lowering the price of the of developing country export. In what follows, we show that this policy asymmetry can play a critical role in the design of trade policies, and trade agreement between the two countries.

The Rationale for Protection in the Presence of Offshoring

We begin by demonstrating the trade policy incentive consequences of the asymmetry illustrated in Proposition 1. From the perspective of the developed country, equilibrium indirect utility is given by

$$V^* = p^*x - wx^* \int_0^I \beta t(i) di + F(\mathcal{L}^* - L^*(w)) + \Psi(p^*), \quad (12)$$

where gross national product is given by the total revenue in the two sectors of the economy, $p^*x + F(\mathcal{L}^* - L^*(w))$, net of the cost of offshoring, $w(1 + \tau^*)x^* \int_0^I \beta t(i) di$. Assuming that government revenue ($w\tau^*x^* \int_0^I \beta t(i) di$) is redistributed back to consumers through lump sum transfers, (12) above follows.

By construction, the developed country imports completed labor tasks from the developing country. We put no addition restrictions on parameter values and as such the developed country may be an export only of x , or of both x and y . Let E^* denote the value of total export in F which, in the presence of balanced trade, is equal to the value of total imports. Also let $s_w^* \in [0, 1] = w(1 + \tau^*)x^* \int_0^I \beta t(i) di / E^*$ denote the share of offshored tasks in the countries total imports, and $s_x^* = p^*(x^* - \mathcal{L}^*c_x(p^*)) / E^*$ the share x in the developed country's total export.

Evaluated at $\tau^* = 0$,

$$\begin{aligned} \frac{dV^*}{d\tau^*} \Big|_{\tau^*=0} &= p^*x^* \frac{\hat{p}^*}{\hat{\tau}^*} - wL(w) \frac{\hat{w}}{\hat{\tau}^*} - p^*\mathcal{L}^*c_x \frac{\hat{p}^*}{\hat{\tau}^*} \\ &= wx^* \int_0^I \beta t(i) di \left(\frac{\hat{p}^*}{\hat{\tau}^*} - \frac{\hat{w}}{\hat{\tau}^*} \right) \\ &= E^* \left(s_w^* \frac{\hat{p}^*}{\hat{\tau}^*} - s_x^* \frac{\hat{w}}{\hat{\tau}^*} \right). \end{aligned}$$

From Proposition 1, the developed country is predisposed to impose an import tariff for

two reasons, both related to terms of trade gains: to raise the price of her exports p^* , and to lower the price of her imports w .

General equilibrium indirect utility in the developing country is given by

$$V = wL(w) + F(\mathcal{L} - L(w)) + \tau p^* \mathcal{L} c_x(p^*(1 + \tau)) + \Psi(p^*),$$

to recall, $L(w) = x^* \int_0^I \beta t(i) di$ denotes labor employment in H engaged in offshored tasks. Now let E denote the value of total export in H , or equivalent the value of total imports with balanced trade. Also let $s_w = wL(w)/E$ denote the share of offshored tasks in the developing country's total exports, and $s_x = p^*(1 + \tau)c_x(p^*(1 + \tau))/E$ the share of x in the developing country's total imports. Evaluated at $\tau = 0$,

$$\begin{aligned} \frac{dV}{d\tau}_{\tau=0} &= wL(w) \frac{\hat{w}}{\hat{\tau}} - p^* \mathcal{L}^* c_x \frac{\hat{p}^*}{\hat{\tau}} \\ &= E \left(s_w \frac{\hat{w}}{\hat{\tau}} - s_x \frac{\hat{p}^*}{\hat{\tau}} \right) \end{aligned}$$

From Proposition 1, an import tariff from the developing country lowers p^* by restricting demand, as it also lowers the wage w in the developing country. These two effects thus work in opposite directions in terms of developing country welfare. Using (9), we find that on balance:

Proposition 2 *An small increase in τ^* always increases the developed country welfare. An small increase τ is improves the developing country welfare only if*

$$\frac{s_w}{s_x} < \frac{\epsilon + \eta^*(1 - \theta^*) + \eta\theta^*}{\eta^* + \epsilon}.$$

Otherwise, developing country welfare always decreases with τ .

It follows that an offshoring relationship can give rise to strong disincentives for the developing country to implement unilateral trade restrictions through τ . If an import subsidy is not an option due to budgetary considerations, the developing country is better off engaging in free trade even in the absence of a trade agreement. By contrast, the developed country will be strictly better off imposing import tariffs for the purpose of terms of trade gains through both trade in output p^* and in inputs w .

Dispute Settlement Reciprocity in the Presence of Offshoring

Suppose now that a trade agreement has been struck and the two countries have agreed to maintain a pair of import tariffs (τ, τ^*) . We now examine the role of an offshoring relationship on the effectiveness of dispute settlement reciprocity to settle disputes. Following Bagwell and Staiger (2012), with dispute settlement reciprocity, the trade agreement stipulates that any unilateral violation of the agreed upon tariffs will be met with countervailing tariffs such that the value of market access remain unchanged.

Let 0 denotes a trade agreement phase, and 1 denote a violation by the developed country with countervailing tariffs from the developing country. Dispute settlement reciprocity requires that:

$$w_0(L(w_1) - L(w_0)) + (m_1^* - m_0^*) = p_0^* \mathcal{L}(c_x(p_1^*(1 + \tau_1)) - c_x(p_0^*(1 + \tau_0)))$$

where without loss of generality, m_i^* denotes developed country imports (exports if negative) of y in phase $i = 0, 1$. Now, from balanced trade:

$$\begin{aligned} w_0(L(w_1) - L(w_0)) + (m_1^* - m_0^*) &= p_0^* \mathcal{L}(c_x(p_1^*(1 + \tau_1)) - c_x(p_0^*(1 + \tau_0))) \\ w_0 L(w_1) + m_1^* &= p_0^* \mathcal{L} c_x(p_1^*(1 + \tau_1)) \\ (w_0 - w_1)L(w_1) &= (p_0^* - p_1^*) \mathcal{L} c_x(p_1^*(1 + \tau_1)) \\ s_{w_1} \left(\frac{w_0 - w_1}{w_1} \right) &= s_{x_1} \left(\frac{p_0^* - p_1^*}{p_1^*} \right). \end{aligned}$$

Consider first the special case where $s_w = s_x = 1$ so that good y is a non-traded good. Consistent with the Bagwell-Staiger rationale, dispute reciprocity requires that the price of developing country exports w and the price of the developed country export p^* change at the same rate in such a way that the ratio w/p^* remains unchanged, or $(w_1 - w_0)/w_1 = (p_0^* - p_1^*)/p_1^*$. More generally, if y is also traded, dispute settlement reciprocity requires that the two countries have at their disposal trade policies that are able to nullify any terms of trade gains obtained by another country, appropriately weighted by the shares of these goods in a country's total import.

Consider therefore a trade agreement violation by the developed country, for example, through an increase in the import tax τ^* . From Proposition 1, such an import tax

decreases w and increases p^* . Any countervailing increase in the developing country import tax τ will need to act through p^* as both w and p^* decrease with τ from Proposition 1. Using (9), the combined effect of the two import tariffs is given by:

$$s_w \hat{w} - s_x \hat{p}^* = \frac{[s_w(\eta^* + \epsilon) - s_x(\epsilon + \eta^*(1 - \theta^*) + \eta\theta^*)] \hat{p}^* - [\eta(1 - \theta^*) + \epsilon] \hat{\tau}^*}{\epsilon + \eta^*(1 - \theta^*) + \eta\theta^*}.$$

It follows there for any $\hat{\tau}^* > 0$ an $\hat{\tau} > 0$, $s_w \hat{w} - s_x \hat{p}^*$ is always negative if $s_w^*(\eta^* + \epsilon) - s_x(\epsilon + \eta^*(1 - \theta^*) + \eta\theta^*) > 0$. Put another way:

Proposition 3 *There does not exist a developing country import tariff $\tau > 0$ that can nullify the terms of trade impact of a developed country import tariff if*

$$\frac{s_w}{s_x} > \frac{\epsilon + \eta^*(1 - \theta^*) + \eta\theta^*}{\eta^* + \epsilon}.$$

It follows that an offshoring relationship renders dispute settlement reciprocity ineffective as means to discourage trade agreement violation by the developed country. With rational expectations, the result is either that a trade agreement either never takes place, or even if it does a trade agreement which accommodates developed country import tariffs will be instituted.

4 The Labor Standards, Offshoring and Trade Agreement Nexus

In this section, we develop three extensions of the basic model to illustrate the important role that labor standards play in trade agreements between economies engaged in offshoring relationships. Specifically, we look at three regimes: (i) a binding well-enforced minimum wage; (ii) an imperfectly enforced minimum wage setting with an informal sector, and (iii) a well-enforced minimum wage with developing country offshoring in a third country.

4.1 A Binding Minimum Wage

Consider a setting wherein workers in the developing country employed in the offshoring sector are now protected by a well-enforced minimum wage, \bar{w} . In doing so, developed

country producers are not able to undercut \bar{w} when trade tax τ^* increases. The wage in the rest of the economy continues to be competitively determined. It follows that zero profit implies

$$\theta^* \hat{w}^* = \hat{p}^* - (1 - \theta^*) \hat{\tau}^* - (1 - \theta^*) \hat{w}. \quad (13)$$

The above determines the relative wage cost, as

$$\begin{aligned} \hat{\rho} &= \hat{w}^* - \hat{w} - \hat{\tau}^* \\ &= \frac{\hat{p}^* - \hat{w} - \hat{\tau}^*}{\theta^*}. \end{aligned} \quad (14)$$

Together, these imply that offshoring jobs protected by a minimum wage are rationed, since from (2), (13) and (14) total output x^* decreases with the minimum wage:

$$\frac{\hat{x}^*}{\hat{w}} \equiv \bar{e}_{xw} = -(\eta^*(1 - \theta^*) + \frac{\epsilon}{1 + \pi})/\theta^*.$$

Total output x^* also decreases with the developed country import tax τ^* :

$$\frac{\hat{x}^*}{\hat{\tau}^*} \equiv \bar{e}_{x\tau^*} = -(\eta^*(1 - \theta^*) + \frac{\epsilon}{1 + \pi})/\theta^*.$$

Finally, total output rises with p^* , as

$$\frac{\hat{x}^*}{\hat{p}^*} \equiv \bar{e}_{xp}^* = \left(\eta^* + \frac{\epsilon}{1 + \pi} \right) / \theta^*.$$

and thus using (11), we obtain:

$$\hat{p}^* = \frac{-(1 - s^*)e_c \hat{\tau} + \bar{e}_{x\tau^*} \hat{\tau}^*}{s^* e_c^* + (1 - s^*)e_c + \bar{e}_{xp}^*}, \quad (15)$$

we have thus

Proposition 4 *With a binding minimum wage, an increase in the developing country import tax decreases the price of the developed country export p^* , while an increase in the developed country import tax increases it.*

With a minimum wage protection, developed country welfare is given by:

$$V^* = p^* x - \bar{w} x^* \int_0^I \beta t(i) di + F(\mathcal{L}^* - L^*(w)) + \Psi(p^*). \quad (16)$$

Evaluated at $\tau^* = 0$,

$$\begin{aligned}\frac{dV^*}{d\tau^*}\Big|_{\tau^*=0} &= p^* x^* \frac{\hat{p}^*}{\hat{\tau}^*} - p^* \mathcal{L}^* c_x \frac{\hat{p}^*}{\hat{\tau}^*} \\ &= -E^* s_x^* \frac{\hat{p}^*}{\hat{\tau}^*} > 0.\end{aligned}$$

Thus, even without the benefit of reducing the cost of offshoring (\bar{w}), the developed country continues to favor imposing an import tariff for the purpose of raising p^* . As for the developing country aggregate utility in the developing country is given by

$$V = \bar{w}L(w) + F(\mathcal{L} - L(w)) + \tau p^* \mathcal{L} c_x(p^*(1 + \tau)) + \Psi(p^*).$$

Evaluated at $\tau = 0$,

$$\begin{aligned}\frac{dV}{d\tau} &= (\bar{w} - w) \frac{dL(w)}{dw} L(w) - p^* \mathcal{L} c_x \frac{\hat{p}^*}{\hat{\tau}^*} \\ &= (\bar{w} - w) \eta \frac{\hat{w}}{\hat{\tau}} - p^* \mathcal{L} c_x(p^*) \frac{\hat{p}^*}{\hat{\tau}} > 0\end{aligned}$$

if \bar{w} is not too different than the competitive wage. In summary,

Proposition 5 *With a binding minimum wage sufficiently close to the competitive wage, a small increase in the developing country import tax τ is always welfare improving for the developing country, and a small increase in τ^* is welfare improving for the developed country.*

A binding minimum wage thus encourages the developing country to take advantage of the terms of trade benefits of an import tariff, even in the presence of offshoring.

Now, suppose a trade agreement is struck requiring the two countries to restrict their import tariffs at τ and τ^* respectively. Dispute settlement reciprocity requires that:

$$\begin{aligned}\bar{w}(L(w_1) - L(w_0)) + (m_1^* - m_0^*) &= p_0^* \mathcal{L}(c_x(p_1^*(1 + \tau_1)) - c_x(p_0^*(1 + \tau_0))) \\ \bar{w}L(w_1) + m_1^* &= p_0^* \mathcal{L} c_x(p_1^*(1 + \tau_1)) \\ 0 &= (p_0^* - p_1^*) \mathcal{L} c_x(p_1^*(1 + \tau_1)).\end{aligned}$$

We have thus the following result:

Proposition 6 *In the presence of a minimum wage \bar{w} , for any developed country trade agreement violation $\hat{\tau}^* > 0$, there exists a corresponding $\hat{\tau}$ such that both p^* and the value of total trade remain the same.*

The above shows that well-enforced labor standards in the form of a minimum wage has two effects. It unlocks the ability on the part of the developing country to use her own trade tax to nullify the adverse consequences of the developed country policies. Second, a well enforced minimum wage also restore the ability of the dispute settlement reciprocity to deter the developed country from violating the trade agreement.

4.2 An Informal Sector

A well-enforced minimum wage is more often an exception rather than the rule (Basu, Chau and Kanbur (2009, 2015)). In this extension of our basic model, we assume that enforcement of the minimum wage is lax, and many workers are employed in the informal sector of the labor market.

4.3 Offshoring to a third party country

In this setting, producers send labor tasks to be completed in a third country. **Note:** this will be a setting where both developed and developing country can offshore their x sector tasks to another country in the world. (e.g. U.S.-China- Vietnam) Let the third party country wage to be given, say because F and H are small relative to the third party.

4.4 Nash Bargaining with in a bilateral trade agreement

In this extension, we consider a two-country setting in which two countries negotiate the terms of a trade a agreement using Nash bargaining.

5 Discussion and Conclusion

Offshoring has become and 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. These new challenges provide 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 developing 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 not protected by a minimum wage, the developing country is rendered unable to nullify the terms of trade impact of an import tariff by the developed nation, for any developing country tariff will further deteriorate the developing country's terms of trade through a reduction in their wages. We show that a well-enforced minimum wage resolve this difficulty on the part of the developing nation to impose import tariffs by severing the link between the export demand facing the developed nation, and wages in the developing country. Thus, labor standards in this context can facilitate the signing of trade agreements enabling countries to use retaliatory measures ensuring that violators can appropriately punished.

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Table 1: Mean Domestic Content of Imports in 63 Countries

Year	Mean Domestic Content of Imports	Std. Dev.	Min	Max
2005	0.4528	1.1438	0	22.06
2006	0.4658	1.1331	0	21.15
2007	0.4650	1.1218	0	20.16
2008	0.4695	1.1122	0	18.89
2009	0.4291	1.0465	0	18.42
2010	0.4512	1.0952	0	17.87
2011	0.4645	1.1128	0	17.61
2012	0.4668	1.1347	0	17.89
2013	0.4650	1.1371	0	18.19
2014	0.4528	1.1321	0	17.85

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

