A ‘New Trade’ Theory of GATT/WTO Negotiations*

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Abstract

I offer a new explanation for why GATT/WTO negotiations have been so successful in achieving trade liberalization by providing new rationales for the fundamental GATT/WTO principles of reciprocity and nondiscrimination. Relative to the standard terms-of-trade theory, my theory makes three main contributions: First, it builds on a ‘new trade’ model rather than the neoclassical trade model and thereby closes an important gap in the literature on GATT/WTO negotiations. Second, it does not rely on the terms-of-trade effect and therefore avoids a mechanism whose real-world relevance many observers doubt. Third, it is immediately consistent with the fact that GATT/WTO regulations do not constrain export taxes and therefore offers a solution to the puzzle identified by Ethier (2002).

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1 Introduction

“Without cooperation, we will be lost. Without institutions there will be little cooperation. And without a knowledge of how institutions work – and what makes them work well – there are likely to be fewer, and worse, institutions than if such knowledge is widespread”. Robert O. Keohane (1988: 393)

International trade has been liberalized dramatically during the past half-century. Since the end of World War II, the average ad valorem tariff on manufacturing goods has been reduced from over 40 percent to below 4 percent, making this undoubtedly one of the most important ever acts of economic policy making.

It is widely appreciated that this liberalization was largely the result of a sequence of successful rounds of trade negotiations governed by the General Agreement on Tariffs and Trade (GATT) and later its successor the World Trade Organization (WTO).\footnote{The effectiveness of GATT/WTO negotiations is also documented empirically in the recent studies of Subramanian et al. (forthcoming) and Tomz et al. (forthcoming). Both studies demonstrate that previous contrary findings by Rose (2004a, 2004b) are not robust. According to WTO statistics, industrial countries have cut their tariffs on industrial products by an average 36 percent during the first five GATT rounds (1942-62), an average 37 percent in the Kennedy Round (1964-67), an average 33 percent in the Tokyo Round (1973-79), and an average 38 percent in the Uruguay Round (1986-94).} The GATT/WTO is an institution regulating trade negotiations through a set of prenegotiated articles. The principles of reciprocity and nondiscrimination are usually considered to be the essence of these articles. Generally speaking, the former requires that trade policy changes keep changes in import volumes equal across trading partners and the latter stipulates that the same tariff must be applied against all trading partners for any given traded product.\footnote{I adopt here Bagwell and Staiger’s (1999) interpretation of the rules of reciprocity and nondiscrimination which I will discuss in more detail later on.}

In this paper, I offer a new explanation for why GATT/WTO negotiations have been so successful in achieving trade liberalization by providing new rationales for the fundamental GATT/WTO principles of reciprocity and nondiscrimination. I consider GATT/WTO negotiations in a Krugman (1980) ‘new trade’ model with transport costs.
The main idea is that GATT/WTO negotiations governed by the principles of reciprocity and nondiscrimination help governments escape a production relocation driven prisoner’s dilemma: In a Krugman (1980) environment, each government has an incentive to impose import tariffs since this reduces the domestic price index and thereby increases domestic welfare. This is because import tariffs ensure that more of the world’s manufacturing goods are produced by domestic firms so that less of the goods consumed by domestic consumers are subject to trade costs. This production relocation occurs since import tariffs make the own country a relatively more attractive location for manufacturing production. In particular, a unilateral increase in import tariffs makes foreign manufacturing goods more expensive relative to domestic manufacturing goods in the domestic market so that domestic consumers shift expenditure towards domestic manufacturing goods. As a consequence, domestic manufacturing firms can sell more thus making profits and foreign manufacturing firms can sell less thus making losses. This triggers entry into the domestic manufacturing sector and exit out of foreign manufacturing sectors so that more of the world’s manufacturing goods are produced by domestic firms. However, if all governments impose import tariffs in an attempt to host more of the world’s manufacturing firms, no government actually succeeds and tariffs only push up import prices. This is why governments are stuck in a production relocation driven prisoner’s dilemma if tariffs are set noncooperatively. GATT/WTO negotiations governed by the principles of reciprocity and nondiscrimination help governments escape this prisoner’s dilemma. Essentially, the principles of reciprocity and nondiscrimination jointly ensure that tariff changes no longer entail production relocations and thereby neutralize all trade policy externalities. This is because, under these principles, tariff-induced changes in domestic consumer expenditure towards or away from domestic manufacturing goods are exactly offset by changes in foreign consumer expenditure away from or towards these goods so that tariff changes then leave the number of manufacturing firms constant in all countries. By neutralizing all trade policy
externalities, the principles of reciprocity and nondiscrimination not only guide coun-
tries away from the inefficient noncooperative equilibrium in a way which monotonically
increases welfare in all countries. But they also secure negotiated tariff concessions by
eliminating all incentives to reverse them.

My benchmark is, of course, the standard neoclassical theory of GATT/WTO negoti-
ations developed by Johnson (1953-54), Mayer (1981), and Bagwell and Staiger (1999). As
is well known, this theory argues that GATT/WTO negotiations governed by the
principles of reciprocity and nondiscrimination help governments overcome a terms-of-
trade driven prisoner’s dilemma. It builds on the classic optimal tariff argument that
countries have a unilateral incentive to impose import tariffs in order to improve their
terms-of-trade. Relative to this standard theory, my theory makes three main contribu-
tions. First, it builds on a ‘new trade’ model rather than the neoclassical trade model
and thereby closes an important gap in the literature on GATT/WTO negotiations.
While the standard theory’s focus on the neoclassical trade model is clearly useful as
a starting point, it can still only yield an incomplete understanding of GATT/WTO
negotiations since the neoclassical trade model is itself only an incomplete theory of
international trade. Neoclassical trade theory and ‘new trade’ theory shed light on
distinct dimensions of international trade and it seems unnatural to confine attention
to just one of these dimensions when studying the functioning of GATT/WTO nego-
tiations. Second, my theory does not rely on the terms-of-trade effect and therefore
avoids a mechanism whose real-world relevance many observers doubt. This is also ac-

\[\text{3An alternative theory of multilateral trade agreements is provided by Maggi (1999). It emphasizes}
\text{enforcement considerations, arguing that lower tariffs can be enforced if multilateral retaliation is pos-
\text{sible. Another alternative theory of trade agreements (bilateral or multilateral) is offered by Maggi}
\text{and Rodriguez-Clare (1998 and forthcoming). It stresses commitment considerations, pointing out that}
\text{trade agreements may help governments commit vis-à-vis domestic special interest groups. However,}
\text{neither of these theories focuses on the detailed principles of GATT/WTO negotiations which is the}
\text{topic of the present paper. See especially Bagwell and Staiger (2002) and Dixit (1987) for discussions}
\text{of the literature on GATT/WTO negotiations.}
\]
\[\text{4In particular, the neoclassical model explains inter-industry trade between different countries,}
\text{whereas ‘new trade’ models account for intra-industry trade between similar countries. Given the wide-
\text{spread belief that industrialized countries dominate GATT/WTO negotiations, a ‘new trade’ theory of}
\text{GATT/WTO negotiations is therefore even more evidently needed.}\]
knowledged by Bagwell and Staiger (2002: 181) who write that “many economists are skeptical as to the practical relevance of terms-of-trade considerations for actual trade policy negotiations”. Krugman (1997: 113), for example, argues that "this optimal tariff argument plays almost no role in real-world trade disputes". Recent supportive evidence by Bagwell and Staiger (2006) and Broda et al. (forthcoming) may actually reduce some of this skepticism. However, it is unlikely to convince observers that the GATT/WTO’s only role is to prevent governments from terms-of-trade manipulations, as is suggested by Bagwell and Staiger (1999). Third, my theory is immediately consistent with the fact that GATT/WTO regulations do not constrain export taxes and therefore offers a solution to the puzzle identified by Ethier (2002): Since GATT/WTO regulations do not constrain export taxes, they actually do not prevent countries from influencing their terms-of-trade. This is because, by Lerner symmetry, all effects of import tariffs can be exactly replicated by export taxes in general equilibrium. Therefore, if countries’ trade policy choices were really driven by a desire to influence their terms-of-trade, the GATT/WTO’s failure to restrict export taxes should lead to a widespread use of them. This is, however, not observed in practice.

I develop my ‘new trade’ theory in the remainder of this paper. In the next section, I introduce the basic two-country model and use this model to establish that the

5In my model, an export tax would reduce the sales of domestic firms by shifting foreign consumer expenditure towards foreign manufacturing goods. This would make the own country a less attractive location for manufacturing production and thus trigger a relocation of manufacturing production towards foreign firms.

6One obvious objection to this criticism seems that countries are anyway constrained from using export taxes for political economy reasons. However, Bagwell and Staiger’s (1999) analysis suggests that this objection is in fact misguided. In particular, they represent government preferences by a general function of local and world prices. The only structure they impose on this function is that, for given local prices, governments prefer better terms-of-trade. They explain that this formulation of government preferences is so general that it can also capture distributional motives emphasized in leading political economy models. According to the Lerner symmetry theorem, import tariffs and export taxes have exactly the same effect on world and local prices. Hence, with respect to the government preferences used by Bagwell and Staiger (1999) both trade policy instruments are indeed perfect substitutes. Therefore, if the GATT/WTO forces governments to reduce import tariffs they should be expected to respond by increasing export taxes even if they are motivated by political economy considerations. Hence, one would have to modify Bagwell and Staiger’s (1999) model in a way which makes Lerner symmetry break down in order to invalidate this criticism (e.g. by introducing an additional freely traded good). However, one would then also have to check whether all their results still hold after this modification.
non-cooperative equilibrium is inefficient. I also demonstrate how trade negotiations governed by the principle of reciprocity help countries overcome this inefficiency in a way which monotonically increases welfare in both countries. In the third section, I then develop a three-country extension of this basic model and use this extended model to show that the principle of reciprocity alone is now no longer sufficient to help countries overcome the inefficient equilibrium in a way which monotonically improves welfare in all countries. I also demonstrate that, if the principle of reciprocity is augmented with the principle of nondiscrimination, they then together serve this purpose. In the fourth section, I explore whether preferential trade agreements which are allowed under GATT/WTO regulations as an exception to the principle of nondiscrimination undermine the functioning of multilateral GATT/WTO negotiations. In the final section I then conclude.

2 The basic model

2.1 Setup

There are two countries: Home and Foreign. Variables relating to Foreign are identified by an asterisk. Consumers have access to a continuum of differentiated manufacturing goods and a single homogeneous ‘outside good’. Preferences over these goods are identical in both countries. They are given by the following utility functions

\[
U = \left[ \int_0^{n+n^*} m(i) \frac{\sigma-1}{\sigma} \, di \right] \frac{\mu^\sigma}{\sigma-1} Y^{1-\mu}, \quad \sigma > 1
\]  

(1)

\[
U^* = \left[ \int_0^{n+n^*} m^*(j) \frac{\sigma-1}{\sigma} \, dj \right] \frac{\mu^\sigma}{\sigma-1} Y^{*1-\mu}, \quad \sigma > 1
\]  

(2)
where $m(i)$ denotes consumption of a differentiated manufacturing good, $Y$ denotes consumption of the homogeneous outside good, $n$ is the ‘number’ of manufacturing goods produced, $\sigma$ is the elasticity of substitution between manufacturing goods, and $\mu$ is the share of income spent on manufacturing goods. Technologies are also identical in both countries. They are summarized by the following (inverse) production functions

$$l^M = f + cq^M$$

$$l^*M = f + cq^*M$$

$$l^Y = q^Y$$

$$l^*Y = q^*Y$$

where $l^M (l^Y)$ is the labor requirement for producing $q^M (q^Y)$ units of a manufacturing good (the outside good), and $f (c)$ denotes the fixed (marginal) labor requirement of manufacturing production. The manufacturing goods market is monopolistically competitive whereas the outside good market is perfectly competitive. Trade costs only apply to manufacturing goods and take the familiar ‘iceberg’ form. These ‘iceberg’ trade costs are denoted by $\phi$. They are further decomposed into ‘iceberg’ transport costs $\theta$, which are identical across countries, and ‘iceberg’ tariffs $\tau$, which may be different across countries. These tariffs can take any value in the interval $[0, \bar{\tau}]$, where $\bar{\tau}$ is some arbitrarily large but finite upper bound. Hence,

$$\phi = \theta + \tau, \quad \theta > 1, \quad \bar{\tau} \geq \tau \geq 0$$

$$\phi^* = \theta + \tau^*, \quad \theta > 1, \quad \bar{\tau} \geq \tau^* \geq 0$$

The assumption that trade costs do not apply to the outside good sector is made for two reasons: First, as standard, to pin down the economies’ wage rate which greatly improves
the model’s tractability. But second, also to ensure that world prices are kept constant thereby eliminating any role for terms-of-trade effects. With fixed world prices, a given quantity of an export good always commands the same quantity of an import good so that tariff-induced improvements in the terms of international exchange are ruled out. The assumption of ‘iceberg tariffs’ is also made for two reasons: First, it greatly simplifies the analysis because like that no tariff revenue is generated. In the same way ‘iceberg’ transport costs are commonly used as a simple way of introducing transport costs without having to model the transport sector explicitly, ‘iceberg’ tariffs are used here as a simple way of introducing tariffs without having to model the government sector explicitly.\(^7\) Second, tariff revenue anyway plays no role in the mechanism isolated in this paper so that it seems cleaner to just disregard it. As will become clear shortly, governments set tariffs in this model in an attempt to attract manufacturing production from abroad and not in an attempt to raise tariff revenue as is the case in the standard neoclassical model. The assumption that tariffs are restricted by a finite upper bound is only made for technical convenience. Dropping it would only complicate the analysis without changing the results in any interesting way. I will explain in detail how a result is affected by dropping this assumption whenever this applies.\(^8\) For simplicity, I also make the following two additional assumptions: First, I assume that the manufacturing sector is always active in both countries. This is ensured for all possible \((\tau, \tau^*, \bar{\tau})\) if and only if transport costs are sufficiently large: \(\theta > \left[ \min(L, L') \right]^{1-\sigma} \) (see appendix A1 for details). Second, I assume that the outside good sector is always active in both countries. This is ensured for all possible \((\tau, \tau^*, \bar{\tau})\) if and only if demand for manufacturing goods is sufficiently small: \(\mu < 1 - \theta^{1-\sigma}\) (see again appendix A1 for details).

\(^7\)In fact, without this assumption the model becomes so complicated that it seems impossible to analyze it analytically. The main problem is that tariff revenue is a very complicated function of tariffs. Home’s tariff revenue, for example, depends on Home’s tariffs directly but also indirectly through Home’s income, Home’s price index, and Foreign’s number of firms.

\(^8\)To be added.
2.2 No trade policy

Consider now the equilibrium at Home and Foreign, exogenously fixing tariffs at some level. Choose \( p^Y = 1 \) and notice that this implies \( w = w^* = 1 \), where \( w \) is the wage rate, since the outside good sector is always active in both countries, the outside good market is perfectly competitive, the outside good is produced using the above technology, and is freely traded among countries. As is well-known, utility maximization with the above preferences then yields the following demands for the outside good

\[
Y = (1 - \mu) L 
\]

\[
Y^* = (1 - \mu) L^*
\]

and the following demands for each manufacturing good

\[
m(i) + m^*(i) = \mu L p(i)^{-\sigma} + \mu L^* \phi^{1-\sigma} p(i)^{-\sigma} \]

\[
m(j) + m^*(j) = \mu L^* \phi^{1-\sigma} p^*(j)^{-\sigma} + \mu L^* p^*(j)^{-\sigma} \]

where the former is the demand facing a Home manufacturing firm, the latter is the demand facing a Foreign manufacturing firm, \( p(i) \) denotes the ex-factory price of a manufacturing good, and the price indices are given by

\[
G = \left[ \int_0^n p(i)^{1-\sigma} \, di + \int_0^n [\phi p^*(j)]^{1-\sigma} \, dj \right] \left[ \frac{1}{1-\sigma} \right] \]

\[
G^* = \left[ \int_0^n [\phi^* p(i)]^{1-\sigma} \, di + \int_0^n p^*(j)^{1-\sigma} \, dj \right] \left[ \frac{1}{1-\sigma} \right] \]

Since these manufacturing demand functions have a constant price elasticity of \( \sigma \), profit-maximization implies that manufacturing firms charge a constant mark-up over marginal
costs so that
\[ p(i) = p^*(j) = \frac{\sigma c}{\sigma - 1} = p \] (15)

which implies that the price indices simplify to
\[ G = p \left[ n + n^* \phi^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \] (16)
\[ G^* = p \left[ n \phi^{1-\sigma} + n^* \right]^{\frac{1}{1-\sigma}} \] (17)

Free entry drives manufacturing firms’ profits down to zero leading to the following break-even outputs
\[ q = q^* = \frac{f(\sigma - 1)}{c} \] (18)

and hence the following break-even labor demands
\[ l = l^* = f \sigma \] (19)

Manufacturing market clearing thus requires
\[ q = \mu L \frac{G^{1-\sigma}}{p^{1-\sigma} G^{1-\sigma}} + \mu L^* \frac{\phi^{1-\sigma} p^{1-\sigma}}{G^{1-\sigma} G^{1-\sigma}} \] (20)
\[ q = \mu L \phi^{1-\sigma} p^{1-\sigma} G^{1-\sigma} + \mu L^* p^{1-\sigma} G^{1-\sigma} \] (21)

These manufacturing market clearing conditions can be solved for the equilibrium price indices
\[ G = \left[ \frac{q p^{1-\sigma} (1 - \phi^{1-\sigma})}{\mu L \left[ 1 - (\phi^* \phi^{1-\sigma})^{1-\sigma} \right]} \right]^{\frac{1}{\sigma-1}} \] (22)
\[ G^* = \left[ \frac{q p^{1-\sigma} (1 - \phi^{1-\sigma})}{\mu L^* \left[ 1 - (\phi^* \phi^{1-\sigma})^{1-\sigma} \right]} \right]^{\frac{1}{\sigma-1}} \] (23)
These equilibrium price indices can then be solved for the equilibrium numbers of manufacturing firms

\[
n = \frac{\mu}{qp} \left( \frac{L}{1 - \phi^{1-\sigma}} - \frac{L\phi^{1-\sigma}}{1 - \phi^{1-\sigma}} \right) \tag{24}
\]

\[
n^* = \frac{\mu}{qp} \left( \frac{L^*}{1 - \phi^{1-\sigma}} - \frac{L\phi^{1-\sigma}}{1 - \phi^{1-\sigma}} \right) \tag{25}
\]

Notice that this implies that the world number of manufacturing firms is always constant and given by\(^9\)

\[
n + n^* = \frac{\mu(L + L^*)}{qp} \tag{26}
\]

Notice further that, given the above demands, the indirect utility functions are

\[
V = \mu^\mu (1 - \mu)^{(1-\mu)} LG^{-\mu} \tag{27}
\]

\[
V^* = \mu^\mu (1 - \mu)^{(1-\mu)} L^* G^{*\mu} \tag{28}
\]

so that each country’s welfare is decreasing in its manufacturing price index. This completes the derivation of the basic model.

### 2.3 Noncooperative trade policy

Consider now trade policy if tariffs are set noncooperatively. I assume throughout that governments choose trade policy in an attempt to maximize their citizens’ welfare. In the following, I characterize the noncooperative equilibrium in two steps: First, I show that the noncooperative equilibrium involves maximum protection. Second, I demonstrate that the noncooperative equilibrium is inefficient.

Thus, notice first that the noncooperative equilibrium involves maximum protection since each government always has an incentive to increase its tariff. This is because

\(^9\)This is because world expenditure on manufacturing goods is constant and given by \(\mu(L + L^*)\) and firm sales are constant and given by \(qp\). This, of course, depends on the particular functional form assumptions made above.

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each country’s price index is always decreasing in its own tariff, as can be seen from equations (22 and 23). Underlying this are two opposing effects of the own tariff on the own price index. In the following, I refer to these effects as import price effect and production relocation effect, respectively. On the one hand, an own tariff simply makes imported goods more expensive thereby increasing the own price index. On the other hand, an own tariff leads to a relocation of manufacturing production from the foreign manufacturing sector towards the domestic manufacturing sector thereby reducing the domestic price index since a smaller number of products consumed domestically are now subject to trade costs. This relocation occurs because an increase in the own tariff makes the own country a more and the other country a less attractive location for manufacturing production. In particular, a unilateral increase in the own tariff implies that manufacturing goods imported from the other country become more expensive relative to domestic manufacturing goods so that domestic consumers shift expenditure towards domestic manufacturing goods. As a consequence, domestic manufacturing firms can sell more thus making profits and foreign manufacturing firms can sell less thus making losses. This triggers entry into the domestic manufacturing sector and exit from the foreign manufacturing sector so that more of the world’s manufacturing goods are produced by domestic firms. In equilibrium, the production relocation effect dominates the import price effect because firms have to make zero profits due to free entry. Essentially, a country’s increased attractiveness as a location for manufacturing production eventually needs to be counterbalanced by increased domestic competition, i.e. a lower domestic price index. This statement can be made more precise with reference to Home’s manufacturing market clearing condition (20). If Home imposes a tariff against Foreign, this initially increases Home’s price index because of the import price effect thereby boosting sales and profits of Home firms. To restore equilibrium, firms have to relocate from Foreign to Home in the sense that Home’s manufacturing production eventually needs to be counterbalanced by increased domestic competition, i.e. a lower domestic price index. This statement can be made more precise with reference to Home’s manufacturing market clearing condition (20). If Home imposes a tariff against Foreign, this initially increases Home’s price index because of the import price effect thereby boosting sales and profits of Home firms. 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sector expands at the expense of Foreign’s manufacturing sector. Such a relocation reduces Home’s price index and increases Foreign’s price index which makes it harder for Home firms to sell goods at Home but easier for Home firms to sell goods at Foreign. Notice that therefore Home’s post-tariff equilibrium price index must be below its pre-tariff level. If it merely returned to its pre-tariff level, Home firms could still export more than before and would therefore make positive profits. This finding is summarized in proposition 1.\footnote{Of course, governments would never impose export taxes in this framework. This is because an export tax deteriorates a country’s relative market access thereby making firms move abroad.}

**Proposition 1** Suppose governments choose tariffs simultaneously, Home maximizing $V$ and Foreign maximizing $V^*$. Then the unique Nash equilibrium tariff combination is $(\tau, \tau^*) = (\overline{\tau}, \overline{\tau})$

**Proof.** See appendix A2 \( \blacksquare \)

Observe second that this noncooperative equilibrium is inefficient since both governments try to gain at the expense of one another. Essentially, if both governments impose import tariffs in an attempt to host more of the world’s manufacturing firms, no government actually succeeds and tariffs only push up import prices in both countries. This is established more formally in the second proposition. This proposition also describes more generally which tariff combinations are efficient which will be useful later in the analysis:

**Proposition 2** The set of Pareto-efficient tariff combinations consists of all $(\tau, \tau^*)$ such that $(\tau, \tau^*) = (\text{any possible } \tau, 0)$ or $(\tau, \tau^*) = (0, \text{any possible } \tau^*)$

**Proof.** See appendix A2 \( \blacksquare \)

**Corollary 1** The trade war equilibrium tariffs $(\tau, \tau^*) = (\overline{\tau}, \overline{\tau})$ are inefficient
Intuitively, Pareto improvements can only be achieved through bilateral tariff reductions. This is because a unilateral tariff cut reduces the welfare of the liberalizing country due to the production relocation effect. However, bilateral tariff reductions are only possible if tariffs are positive in both countries so that Pareto improvements cannot be achieved if the tariff is zero in at least one of the countries.

2.4 Trade policy under the GATT/WTO: The principle of reciprocity

Consider now trade policy, if tariffs are set cooperatively subject to GATT/WTO regulations. Since the principle of nondiscrimination is trivially satisfied in a two-country world, I focus only on the principle of reciprocity for now. I adopt Bagwell and Staiger’s (1999) interpretation of this principle:\textsuperscript{12} Generally speaking, reciprocity requires that trade policy changes keep changes in import volumes equal across trading partners. However, this principle has two particular applications in GATT/WTO practice and is not binding to the same degree in both these applications. First, governments are required to seek a ‘balance of concessions’ during rounds of trade liberalization in the sense that they cut tariffs reciprocally. While this application is considered to be important in practice it is actually not encoded in GATT/WTO articles and therefore not binding in a legal sense. Second, governments are entitled to ‘withdraw substantially equivalent concessions’ if a trading partner increases previously bound tariffs in the sense that they retaliate reciprocally. This right is encoded in GATT/WTO articles and therefore has legal status.

In the following, I demonstrate that the principle of reciprocity can be viewed as helping countries overcome the inefficient noncooperative equilibrium in a way which monotonically increases welfare in both countries. I develop the argument in three steps: First, I show that reciprocity prevents production relocations between countries and thereby neutralizes the production relocation effect. Second, I demonstrate that,\textsuperscript{12}

\textsuperscript{12}For a discussion of how this interpretation is obtained, see chapter 3 of Bagwell and Staiger (2002).
as one consequence, reciprocity ensures that negotiated tariff concessions increase both countries’ welfare monotonically. Third, I prove that, as another consequence, reciprocity secures all negotiated tariff concessions by guaranteeing that no country has an incentive to reverse them. Following the above discussion, I adopt the following formal definition of reciprocity throughout:

**Definition 1** Define a tariff change \((d\tau, d\tau^*)\) to be reciprocal if it is such that \(dTBM = 0\), where \(TBM \equiv EXP_M - IMP_M\) and \(EXP_M\) (\(IMP_M\)) refers to the value of manufacturing exports (imports).

Thus, notice first that the principle of reciprocity neutralizes the production relocation effect. This is because the number of firms operating at Home can be decomposed as follows, as is derived in appendix A2:

\[
n = \frac{\mu L}{qp} + \frac{TBM}{qp}
\]  

(29)

This decomposition shows that the number of manufacturing firms at Home consists of the number of manufacturing firms Home would have under autarky plus the additional number of firms required to satisfy the net demand from Foreign. This is because \(\mu L\) is Home’s expenditure on manufacturing goods, \(TBM\) is Foreign’s net expenditure on Home’s manufacturing goods, and \(qp\) is the (constant) level of firm sales. Hence, if Foreign’s net expenditure on Home’s manufacturing goods is fixed by reciprocity, Home’s (and hence also Foreign’s) number of manufacturing firms is fixed as well. This finding is summarized in proposition 3:

**Proposition 3** Tariff changes leave the number of firms unchanged in both countries if and only if they are reciprocal.

**Proof.** See appendix A2.
Observe second that reciprocal tariff concessions therefore increase both countries’ welfare monotonically. To see this, recall that tariffs affect a country’s welfare through two opposing effects: The import price effect which tends to make a country’s price index increasing in its own tariff; and the production relocation effect which tends to make a country’s price index decreasing in its own tariff. As was discussed above, the production relocation effect normally dominates the import price effect so that a country’s price index is actually decreasing in its own tariff. However, if the production relocation effect is neutralized by reciprocity, only the import price effect remains so that a country’s price index then becomes increasing in its own tariff. This result is summarized in proposition 4:

**Proposition 4** Reciprocal trade liberalization monotonically increases welfare in both countries.

**Proof.** See appendix A2 □

Notice third that, by the same token, the principle of reciprocity also secures all negotiated tariff concessions by guaranteeing that no country has an incentive to reverse them. If one country commits to respond reciprocally to any tariff increase above the negotiated tariff levels, then the other country no longer has an incentive to increase its tariff since such an increase would only inflate its price index due to the import price effect. This is illustrated in proposition 5:

**Proposition 5** Suppose tariffs are set in the following two-stage game: In the first stage, governments choose tariffs cooperatively according to some bargaining protocol. In the second stage, Home gets the opportunity to deviate from the cooperative outcome by increasing its tariff unilaterally. However, Foreign commits to respond reciprocally to any unilateral tariff increase by Home. Then, Home never deviates from the cooperative agreement in the second stage.
Proof. See appendix A2.

In summary, the principle of reciprocity can thus be seen as helping governments escape the inefficient noncooperative equilibrium in a way which monotonically increases welfare in both countries. In fact, the principle of reciprocity not only helps governments escape the inefficient equilibrium but also directly guides them to efficient tariffs. This is because countries can liberalize their trade reciprocally unless one country has completely eliminated all its tariffs, which is sufficient for efficiency, from proposition 2.

3 Three-country extension

3.1 Setup

While the basic two-country model is thus useful to illustrate the overall purpose of trade negotiations and the role played by the GATT/WTO principle of reciprocity, it is too simple to shed light on the role played by the principle of nondiscrimination. For this reason, I develop an extension of the basic model in this section. In particular, I focus on the simplest possible setup that allows for discriminatory tariff setting. There are now three countries: Home, Foreign 1, and Foreign 2. Home trades with both Foreign 1 and Foreign 2, but Foreign 1 and Foreign 2 trade with Home only so that only Home can set discriminatory tariffs. Everything else is just as in the basic model.\footnote{One further difference is as follows: For simplicity, I again assume that the manufacturing sector is always active in all countries and that the outside good sector is always active in all countries. However, this now requires tighter parameter restrictions. Details can be found in appendix A1.}

The notation is a straightforward generalization of the one used before. For example, $\tau_1$ is now the tariff imposed by Home against imports from Foreign 1, $\tau_2$ is now the tariff imposed by Foreign 2 against imports from Home, and $G_i$ is the manufacturing price index of Foreign 1.
3.2 No trade policy

The derivation of the equilibrium proceeds exactly as before and is thus not repeated here in detail. Instead, I focus only on its key steps and present only the model’s key relationships. As before, all firms charge the same price in equilibrium and the price indices can be written as

\[ G = p \left[ n + n_1^* \phi_1^{1-\sigma} + n_2^* \phi_2^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \]  

(30)

\[ G_1^* = p \left[ n \phi_1^{1-\sigma} + n_1^* \right]^{\frac{1}{1-\sigma}} \]  

(31)

\[ G_2^* = p \left[ n \phi_2^{1-\sigma} + n_2^* \right]^{\frac{1}{1-\sigma}} \]  

(32)

Manufacturing market clearing requires

\[ q = \mu L \frac{p^{-\sigma}}{G^{1-\sigma}} + \mu L_1^* \phi_1^{1-\sigma} \frac{p^{-\sigma}}{G_1^{1-\sigma}} + \mu L_2^* \phi_2^{1-\sigma} \frac{p^{-\sigma}}{G_2^{1-\sigma}} \]  

(33)

\[ q = \mu L \phi_1^{1-\sigma} \frac{p^{-\sigma}}{G_1^{1-\sigma}} + \mu L_1^* \frac{p^{-\sigma}}{G_1^{1-\sigma}} \]  

(34)

\[ q = \mu L \phi_2^{1-\sigma} \frac{p^{-\sigma}}{G_2^{1-\sigma}} + \mu L_2^* \frac{p^{-\sigma}}{G_2^{1-\sigma}} \]  

(35)

where the equations refer to Home, Foreign 1, and Foreign 2, respectively. These equations can be solved for the equilibrium price indices. Defining

\[ \Phi \equiv 1 - \phi_1^{1-\sigma} - \phi_2^{1-\sigma} \]  

(36)

\[ \Phi_1 \equiv 1 - \phi_1^{1-\sigma} - \phi_2^{1-\sigma} \left( \phi_2^{1-\sigma} - \phi_1^{1-\sigma} \right) \]  

(37)

\[ \Phi_2 \equiv 1 - \phi_2^{1-\sigma} - \phi_1^{1-\sigma} \left( \phi_1^{1-\sigma} - \phi_2^{1-\sigma} \right) \]  

(38)

\[ \Omega \equiv 1 - \left( \phi_1 \phi_2^* \right)^{1-\sigma} - \left( \phi_2 \phi_2^* \right)^{1-\sigma} \]  

(39)
they can be written as

\[ G = \left[ \frac{qp^\sigma \Phi}{\mu L \Omega} \right]^\frac{1}{\sigma - 1} \]  

(40)

\[ G_1^* = \left[ \frac{qp^\sigma \Phi_1}{\mu L_1^\sigma \Omega} \right]^\frac{1}{\sigma - 1} \]  

(41)

\[ G_2^* = \left[ \frac{qp^\sigma \Phi_2}{\mu L_2^\sigma \Omega} \right]^\frac{1}{\sigma - 1} \]  

(42)

These price indices can then be solved for the equilibrium number of firms

\[ n = \frac{\mu}{qp} \left[ \frac{L}{\Phi} - \frac{L_1^* \phi_1^{1-\sigma}}{\phi_1} - \frac{L_2^* \phi_2^{1-\sigma}}{\phi_2} \right] \]  

(43)

\[ n_1^* = \frac{\mu}{qp} \left[ \frac{L_1^* \left[ 1 - (\phi_2 \phi_2^*)^{1-\sigma} \right]}{\phi_1} + \frac{L_2^* (\phi_2^* \phi_2^{1-\sigma})}{\phi_2} - \frac{L_1^* \phi_1^{1-\sigma}}{\phi_1} \right] \]  

(44)

\[ n_2^* = \frac{\mu}{qp} \left[ \frac{L_2^* \left[ 1 - (\phi_1 \phi_1^*)^{1-\sigma} \right]}{\phi_2} + \frac{L_1^* (\phi_1^* \phi_1^{1-\sigma})}{\phi_1} - \frac{L_2^* \phi_2^{1-\sigma}}{\phi_2} \right] \]  

(45)

These expressions again imply that the world number of manufacturing firms is constant. Since there are now three countries, it is given by

\[ n + n_1^* + n_2^* = \frac{\mu \left( L + L_1^* + L_2^* \right)}{qp} \]  

(46)

3.3 Noncooperative trade policy

Consider now again trade policy if tariffs are set noncooperatively. Notice that propositions 1 and 2 naturally generalize to the three-country model, the intuitions being as before. As in proposition 1, all governments choose maximum protection in the noncooperative equilibrium:

**Proposition 6** Suppose governments choose tariffs simultaneously, Home maximizing \( V \), Foreign 1 maximizing \( V_1^* \), and Foreign 2 maximizing \( V_2^* \). Then the unique Nash
Proof. See appendix A2.

As in proposition 2, this noncooperative equilibrium is inefficient since tariff combinations are efficient if and only if at least one of the tariffs is equal to zero in each bilateral trading relationship:

**Proposition 7** The set of Pareto-efficient tariff combinations consists of all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\) such that (i) \((\tau_1, \tau_1^*) = (\text{any possible } \tau_1, 0)\) or \((\tau_1, \tau_1^*) = (0, \text{ any possible } \tau_1^*)\) and (ii) \((\tau_2, \tau_2^*) = (\text{any possible } \tau_2, 0)\) or \((\tau_2, \tau_2^*) = (0, \text{ any possible } \tau_2^*)\)

Proof. See appendix A2.

**Corollary 2** The trade war equilibrium tariffs \((\tau_1, \tau_2, \tau_1^*, \tau_2^*) = (\overline{\tau}, \overline{\tau}, \overline{\tau}, \overline{\tau})\) are inefficient.

However, the fact that propositions 1 and 2 generalize so naturally to the three-country model conceals that tariffs now have more complicated international implications. Besides the import price effect, there is now both a bilateral as well as a multilateral production relocation effect. The bilateral production relocation effect is an effect between the two countries directly affected by the tariff and is just the production relocation effect familiar from the basic model: For example, a tariff imposed by Home against Foreign i leads to production relocations from Foreign i to Home since this increases the sales of firms at Home and reduces the sales of firms at Foreign i thereby making Home more attractive location for manufacturing production. The multilateral production relocation effect is an additional effect on the third country which is not directly affected by the tariff. This multilateral production relocation effect works through changes in Home’s price index: For example, since a tariff imposed by Home against Foreign i leads to production relocations from Foreign i towards Home, Home’s
price index falls. This implies that the Home market becomes more competitive which makes it harder for firms in Foreign \( j \) to sell their products to Home. As a consequence, the number of firms operating in Foreign \( j \) has to fall in equilibrium so that a tariff imposed by Home against Foreign \( i \) does not only lead to production relocations from Foreign \( i \) to Home but also from Foreign \( j \) to Home.

### 3.4 Trade policy under the GATT/WTO: The principle of nondiscrimination

Consider now again trade policy, if tariffs are set cooperatively in GATT/WTO negotiations. In the following, I demonstrate that the principle of reciprocity alone is now no longer sufficient to help countries overcome the inefficient noncooperative equilibrium in a way which monotonically improves welfare in all countries. However, if the principle of reciprocity is augmented with the principle of nondiscrimination they then together serve this purpose. I develop this argument in four steps: First, I show that the principle of reciprocity neutralizes the bilateral production relocation effect but not the multilateral production relocation effect if it is applied bilaterally but that it neutralizes both effects if it is applied multilaterally. Second, I demonstrate that, as a consequence, the principle of reciprocity only ensures that negotiated tariff concessions increase all countries’ welfare monotonically if it is applied multilaterally. Third, I show that the principle of nondiscrimination is a simple way to ‘multilateralize’ the principle of reciprocity. And finally, I demonstrate that under reciprocity and nondiscrimination negotiated tariff concessions are secured. Adapting the earlier definition of reciprocity to the three country case, tariff changes are now required to be bilaterally reciprocal in bilateral trade negotiations and multilaterally reciprocal in multilaterally trade negotiations, where bilateral and multilateral tariff changes are formally defined as follows:

**Definition 2** Define a tariff change \((\Delta \tau_i, \Delta \tau^*_i)\) to be bilaterally reciprocal between Home
and Foreign \( i \) if it is such that \( dTB^*_{Mi} = 0 \), where \( TB^*_{Mi} = EXP^*_{Mi} - IMP^*_{Mi} \) and \( EXP^*_{Mi} \) (\( IMP^*_{Mi} \)) refers to the value of manufacturing exports (imports) in country Foreign \( i \).

Define a tariff change \( (d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*) \) to be multilaterally reciprocal if it is such that \( dTB^*_{M1} = dTB^*_{M2} = 0 \).

Thus, notice first that reciprocity neutralizes the bilateral production relocation effect but not the multilateral production relocation effect if it is applied bilaterally but that it neutralizes both effects if it is applied multilaterally. To see this, observe that the number of manufacturing firms operating in Foreign \( i \) can be decomposed into the number of manufacturing firms Foreign \( i \) would have under autarky plus the additional number of manufacturing firms required to satisfy net foreign demand from Home, just as in the basic model (details can again be found in appendix A2):

\[
n^*_i = L^*_i + \frac{TB^*_{Mi}}{qp}
\]

Hence, if Home and Foreign \( i \) change tariffs in a bilaterally reciprocal way, the number of firms in Foreign \( i \) remains unchanged. Therefore, the principle of reciprocity serves to eliminate the bilateral production relocation effect if it is applied bilaterally. However, it is not sufficient to also eliminate the multilateral production relocation effect in this case. This is because a bilaterally reciprocal tariff change between Home and Foreign \( i \) changes Home’s price index thereby affecting the sales of firms in Foreign \( j \). In particular, if Home and Foreign \( i \) liberalize in a bilaterally reciprocal way, Home’s price index falls which makes it harder for firms in Foreign \( j \) to export their goods to Home. As a consequence, firms in Foreign \( j \) make losses unless some production relocates to Home. This is summarized in proposition 8:

**Proposition 8** Tariff changes leave the number of firms unchanged in all countries if and only if they are multilaterally reciprocal. Moreover, bilaterally reciprocal trade

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liberalization (trade protection) between Home and Foreign i leaves the number of firms unchanged in Foreign i but increases (decreases) the number of firms at Home at the expense of (to the benefit of) Foreign j.

**Proof.** See appendix A2 ■

Observe second that, as a consequence, the principle of reciprocity only ensures that negotiated tariff concessions increase all countries’ welfare monotonically if trade negotiations are multilateral. If Home and Foreign i liberalize in a bilaterally reciprocal way only the bilateral production relocation effect is neutralized so that Foreign i gains because of the import price effect, Home gains because of the import price effect and the multilateral production relocation effect, but Foreign j loses because of the multilateral production relocation effect. If, instead, Home, Foreign i, and Foreign j liberalize in a multilaterally reciprocal way, the multilateral production relocation effect is also neutralized so that all countries gains because of the import price effect. This is summarized in proposition 9:

**Proposition 9** Multilaterally reciprocal trade liberalization monotonically increases the welfare in all countries. Bilaterally reciprocal trade liberalization between Home and Foreign i monotonically increases the welfare in Home and Foreign i but monotonically decreases the welfare in Foreign j.

**Proof.** See appendix A2 ■

Notice third that the principle of nondiscrimination is a simple way to ‘multilateralize’ the principle of reciprocity. The reasoning for this is straightforward: If Home is forced to impose the same tariff against Foreign 1 and Foreign 2, and both Foreign 1 and

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14 Notice that Home needs to be forced to multilateralize the principle of reciprocity. In particular, Home would prefer liberalizing in a bilaterally reciprocal way first vis-a-vis Foreign 1 and second vis-a-vis Foreign 2 to liberalizing in a multilaterally reciprocal way simultaneously vis-a-vis Foreign 1 and Foreign 2. This is because, in the former case, Home would attract manufacturing production from first Foreign 2 and second Foreign 1, due to the multilateral production relocation effect.
Foreign 2 respond to tariff changes by Home in a bilaterally reciprocal way, both trade balances are kept constant so that multilateral reciprocity prevails. This is summarized in proposition 10:

**Definition 3** Define tariffs to be nondiscriminatory if $\tau_1 = \tau_2 \equiv \tau$

**Proposition 10** If tariffs are restricted to be nondiscriminatory, all bilaterally reciprocal tariff changes are also multilaterally reciprocal

**Proof.** See appendix A2 ■

Observe finally that under reciprocity and nondiscrimination all negotiated tariff concessions are secured by guaranteeing that no country has an incentive to reverse them. If Foreign 1 and Foreign 2 commit to respond reciprocally to any tariff increase by Home above the negotiated tariff levels, then Home no longer has an incentive to increase its tariffs. This is again because such an increase in tariffs would only inflate Home’s price index because of the import price effect. This is summarized in proposition 11:15

**Proposition 11** Suppose tariffs are set in the following two-stage game. Throughout all stages, Home is restricted to set nondiscriminatory tariffs. In the first stage, governments choose tariffs cooperatively according to some bargaining protocol. In the second stage, Home gets the opportunity to deviate from the cooperative outcome by increasing its tariffs unilaterally. However, Foreign 1 and Foreign 2 commit to respond reciprocally to any unilateral tariff increase by Home. Then Home never deviates from the cooperative agreement in the second stage

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15 Notice that the principle of nondiscrimination is actually not essential for this result. Even if only the principle of reciprocity was imposed, Home would have no incentive to reverse negotiated tariff concessions against either country since this would inflate its price index due to the import price effect and the multilateral production relocation effect. I elaborate on this in the section on preferential trading agreements.
Proof. See appendix A2 ■

Overall, the principles of reciprocity and nondiscrimination can therefore be interpreted as jointly helping governments to escape the inefficient noncooperative equilibrium in a way which monotonically increases welfare in all countries. Notice, however, that reciprocal trade liberalization no longer necessarily leads to efficient tariffs if the principle of nondiscrimination is imposed. This is because reciprocity and nondiscrimination can only be satisfied if all tariffs are lowered simultaneously. But this is impossible if at least one of the tariffs is equal to zero which is not sufficient for efficiency, from proposition 7. Recall, however, that the requirement to liberalize reciprocally is not binding in a legal sense so that this feature of the principle of nondiscrimination should not be overemphasized.

3.5 Preferential trade agreements

To be added.

4 Conclusion

In this paper, I developed a ‘new trade’ theory of GATT/WTO negotiations. I first argued that tariffs are inefficiently high in the non-cooperative equilibrium because countries attempt to foster their domestic manufacturing sectors at other countries’ expense. I then showed how GATT/WTO negotiations can help countries overcome this inefficiency by providing new rationales for the fundamental GATT/WTO principles of reciprocity and nondiscrimination.

Relative to the standard terms-of-trade theory, this theory makes three main contributions. First, it builds on a ‘new trade’ model rather than the neoclassical trade model and thereby closes an important gap in the literature on GATT/WTO negotiations. Second, it does not rely on the terms-of-trade effect and therefore avoids a
mechanism whose real-world relevance many observers doubt. Third, it is immediately consistent with the fact that GATT/WTO regulations do not constrain export taxes and therefore offers a solution to the puzzle identified by Ethier (2002).

Still, much further work is needed. To fully develop this ‘new trade’ theory of trade negotiations, two questions seem to be particularly important: First, what is the role of political economy considerations in multilateral trade negotiations? And second, how does the GATT/WTO enforce the rules of reciprocity and nondiscrimination?\textsuperscript{16}

\textsuperscript{16}See Bagwell and Staiger (2002) for a discussion of how these questions are addressed in the context of the standard terms-of-trade theory.
References


5 Appendix

5.1 A1: Parameter restrictions

5.1.1 Two-country model

The equilibrium number of manufacturing firms operating at Home is given by $n = \frac{\mu}{\eta p} \left[ \frac{L}{1 - \theta^{1-\sigma}} - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$ from equation (24). Hence, the maximum value $n$ can take for all $(\tau, \tau^*, \bar{\tau})$ is $n_{\text{max}} = \frac{\mu}{\eta p} \left[ \frac{L}{1 - \theta^{1-\sigma}} \right]$ and the minimum value $n$ can take for all $(\tau, \tau^*, \bar{\tau})$ is $n_{\text{min}} = \frac{\mu}{\eta p} \left[ L - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$. By symmetry, $n_{\text{max}}^* = \frac{\mu}{\eta p} \left[ \frac{L^*}{1 - \theta^{1-\sigma}} \right]$ and $n_{\text{min}}^* = \frac{\mu}{\eta p} \left[ L^* - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$. Therefore,

1. The manufacturing sector is always active in both countries for all $(\tau, \tau^*, \bar{\tau})$ if and only if $n_{\text{min}} > 0$ and $n_{\text{min}}^* > 0 \iff \theta > \left( \frac{\min (L,L^*)}{L+L^*} \right)^{1-\sigma}$. Notice that this condition reduces to $\theta > (\frac{1}{2})^{1-\sigma}$ if $L = L^*$.

2. The outside good sector is always active in both countries for all $(\tau, \tau^*, \bar{\tau})$ if and only if Home is large enough to fit $n_{\text{max}}$ and Foreign is large enough to fit $n_{\text{max}}^*$. This is the case if $n_{\text{max}} l < L$ and $n_{\text{max}}^* l < L^* \iff \mu < 1 - \theta^{1-\sigma}$. Notice that this condition reduces to $\mu < \frac{1}{2}$ if $\theta = (\frac{1}{2})^{1-\sigma}$.

5.1.2 Three-country model

The equilibrium number of manufacturing firms operating at Home is given by $n = \frac{\mu}{\eta p} \left[ \frac{L}{1 - \theta^{1-\sigma}} - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$ from equation (43). Hence, the maximum value $n$ can take for all $(\tau_1, \tau_2, \tau^*_1, \tau_2^*, \bar{\tau})$ is $n_{\text{max}} = \frac{\mu}{\eta p} \left[ \frac{L}{1 - 2\theta^{1-\sigma}} \right]$ and the minimum value $n$ can take for all $(\tau_1, \tau_2, \tau^*_1, \tau_2^*, \bar{\tau})$ is $n_{\text{min}} = \frac{\mu}{\eta p} \left[ L - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} - \frac{L^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$. The equilibrium number of manufacturing firms operating at Foreign $i$ is given by $n_i^* = \frac{\mu}{\eta p} \left[ \frac{L_i^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} + \frac{L_i^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} - \frac{L_i^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$ from equations (44 and 45). Hence, the maximum value $n_i^*$ can take for all $(\tau_1, \tau_2, \tau^*_1, \tau_2^*, \bar{\tau})$ is $n_{i\text{max}}^* = \frac{\mu}{\eta p} \left[ \frac{L_i^* \theta^{1-\sigma}}{1 - \theta^{1-\sigma}} \right]$ and the minimum value $n$ can take for all $(\tau_1, \tau_2, \tau^*_1, \tau_2^*, \bar{\tau})$ is $n_{i\text{min}}^* = \frac{\mu}{\eta p} \left[ L_i^* - \frac{L_i^* \theta^{1-\sigma}}{1 - 2\theta^{1-\sigma}} \right]$. Therefore,
1. The manufacturing sector is always active in all countries for all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})\) if and only if \(n_{\text{min}}^* > 0\) and \(n_{1\text{min}}^* > 0\) and \(n_{2\text{min}}^* > 0\) \(\iff\) \(\theta > \left(\frac{L L_1}{L + L_1 + L_2}\right)^{\frac{1}{1-\sigma}}\) and \(\theta > \left(\frac{L L_1}{L + L_1 + L_2}\right)^{\frac{1}{1-\sigma}}\). Notice that this condition reduces to \(\theta > \left(\frac{1}{3}\right)^{\frac{1}{1-\sigma}}\) if \(L = L_1 = L_2\).

2. The outside good sector is always active in all countries for all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})\) if and only if Home is large enough to fit \(n_{\text{max}}\) Foreign 1 is large enough to fit \(n_{1\text{max}}^*\), and Foreign 2 is large enough to fit \(n_{2\text{max}}^*\). This is the case if \(n_{\text{max}}l < L\) and \(n_{1\text{max}}l < L_1^*\) and \(n_{2\text{max}}l < L_2^* \iff \mu < 1 - 2\theta^{1-\sigma}\). Notice that this reduces to \(\mu < \frac{1}{3}\) if \(\theta = \left(\frac{1}{3}\right)^{\frac{1}{1-\sigma}}\).

5.2 A2: Proofs

5.2.1 Proof of proposition 1

**Proof.** Given the form of \(V\), \(V\) is maximized when \(G\) is minimized. Also, \(\frac{\partial G}{\partial \tau} = -\frac{\phi^*(\phi^*)^{-\sigma}}{[1-(\phi^*)^{1-\sigma}]}G\) so that \(\frac{\partial G}{\partial \tau} < 0\) for all possible \((\tau, \tau^*)\). Hence, choosing \(\tau = \bar{\tau}\) is a dominant strategy for Home. Similarly, choosing \(\tau^* = \bar{\tau}\) is a dominant strategy for Foreign. Thus, \((\tau, \tau^*) = (\bar{\tau}, \bar{\tau})\) is the unique Nash equilibrium tariff combination.

5.2.2 Proof of proposition 2

**Proof.** A tariff combination \((\tau, \tau^*)\) cannot be Pareto efficient if there exist possible Pareto improving tariff changes \((d\tau, d\tau^*)\) at \((\tau, \tau^*)\). This includes tariff changes \((d\tau, d\tau^*)\) such that \(dG^* < 0\) and \(dG = 0\). From total differentiation, \(dG = \frac{\partial G}{\partial \tau} d\tau + \frac{\partial G}{\partial \tau^*} d\tau^*\) and \(dG^* = \frac{\partial G^*}{\partial \tau} d\tau + \frac{\partial G^*}{\partial \tau^*} d\tau^*\). Therefore, \(dG = 0\) if \(d\tau = -\frac{\partial G^*}{\partial \tau^*} d\tau^*\) so that \(dG^* = \left(\frac{\partial G^*}{\partial \tau} - \frac{\partial G^*}{\partial \tau^*} \frac{\partial \tau}{\partial \tau^*} d\tau^*\right) d\tau^*\) along \(dG = 0\). Notice that \(\frac{\partial G^*}{\partial \tau^*} - \frac{\partial G^*}{\partial \tau^*} \frac{\partial \tau}{\partial \tau^*} \frac{\partial G^*}{\partial \tau^*} > 0\) for all \((\tau, \tau^*)\). This is because \(\frac{\partial G^*}{\partial \tau} = -\frac{(\phi^*)^{-\sigma} \phi^* G}{1-(\phi^*)^{1-\sigma}}\), \(\frac{\partial G^*}{\partial \tau^*} = \frac{(1-\phi^{1-\sigma}) \phi^{1-\sigma}}{1-(\phi^*)^{1-\sigma}} G\), \(\frac{\partial G^*}{\partial \tau} = \frac{(1-\phi^{1-\sigma}) \phi^{-\sigma}}{1-(\phi^*)^{1-\sigma}} G^*\), and \(\frac{\partial G^*}{\partial \tau^*} = -\frac{(\phi^*)^{-\sigma} \phi^{-\sigma}}{1-(\phi^*)^{1-\sigma}} G^*\) so that \(\frac{\partial G^*}{\partial \tau} \frac{\partial \tau}{\partial \tau^*} \frac{\partial G^*}{\partial \tau^*} = \frac{G^*}{\phi}.\)

Hence, there exist Pareto improving tariff changes \((d\tau, d\tau^*)\) for all \((\tau, \tau^*)\). These
are such that \( d \tau < 0 \) and \( d \tau^* < 0 \) and are thus possible if and only if \( \tau > 0 \) and \( \tau^* > 0 \). Therefore, only \((\tau, \tau^*)\) such that \((\tau, \tau^*) = (\text{any possible } \tau, 0)\) or \((\tau, \tau^*) = (0, \text{any possible } \tau^*)\) can be Pareto efficient. It is easy to verify that for none of these \((\tau, \tau^*)\) there exists another \((\tau, \tau^*)\) which makes one country better off without making the other country worse off. Therefore, they are also indeed Pareto efficient.

5.2.3 Proof of proposition 3

Proof. By definition, \( TB_M = \mu p^{1-\sigma} L G^{\sigma-1} G - n^* \phi^{1-\sigma} L G^{\sigma-1} \) so that \( \frac{TB_M}{\mu} = \frac{n^* \phi^{1-\sigma} L^*}{n^* \phi^{1-\sigma} + n^* L G^{\sigma-1}} \). Also, \( \frac{n \phi L G}{\mu} = \frac{n L G^{\sigma-1}}{n + n^* \phi^{1-\sigma}} \) from Home’s manufacturing market clearing condition. Hence, \( n = n L + \frac{TB_M}{\mu} \) which implies that \( d n = 0 \) if and only if \( d TB_M = 0 \). Finally, since \( n + n^* = \frac{\nu (L^{1-\sigma} + L G^{\sigma-1})}{\mu} \), \( d n^* = 0 \) if and only if \( d n = 0 \).

5.2.4 Proof of proposition 4

Proof. Recall that \( G = p \left[ n + n^* \phi^{1-\sigma} \right] \) and \( G^* = p \left[ n^* \phi^{1-\sigma} + n^* \right] \) from equations (16) and (17). Since reciprocal tariff changes leave the number of firms unchanged in both countries, from proposition 3, reciprocal trade liberalization therefore monotonically decreases both countries’ price indices.

5.2.5 Proof of proposition 5

Proof. Recall that \( G = p \left[ n + n^* \phi^{1-\sigma} \right] \) from equation (16). Since reciprocal tariff changes leave the number of firms unchanged in both countries, from proposition 3, Home’s price index is therefore increasing in its own tariff in the second stage.

5.2.6 Proof of proposition 6

Proof. \( \frac{\partial G}{\partial \tau_i} = \frac{-\partial \phi}{\partial \tau_i} G \) so that \( \frac{\partial G}{\partial \tau_i} < 0 \) for all possible \((\tau_1, \tau_2, \tau^*_1, \tau^*_2)\). Hence, choosing \((\tau_1, \tau_2) = (\overline{\tau}, \overline{\tau})\) is a dominant strategy for Home. Similarly, \( \frac{\partial G^*}{\partial \tau_i} = \frac{-\partial \phi^*}{\partial \tau_i} G^* \) so that \( \frac{\partial G^*}{\partial \tau_i} < 0 \) for all possible \((\tau_1, \tau_2, \tau^*_1, \tau^*_2)\). Hence, choosing \( \tau_i = \overline{\tau} \) is also a dominant strategy.
strategy for Foreign i. Thus, \((\tau_1, \tau_2, \tau_1^*, \tau_2^*) = (\tau, \tau, \tau, \tau)\) is the unique Nash equilibrium tariff combination.

5.2.7 Proof of proposition 7

Proof. A tariff combination \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\) cannot be Pareto efficient if there exist possible Pareto improving tariff changes \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\) at \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\). This includes tariff changes \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\), \(d\tau_2 = d\tau_2^* = 0\), such that \(dG_1^* < 0\) and \(dG = dG^*_2 = 0\). From total differentiation, \(dG = \frac{\partial G}{\partial \tau_1} d\tau_1 + \frac{\partial G}{\partial \tau_1^*} d\tau_1^*\), \(dG_1^* = \frac{\partial G}{\partial \tau_1} d\tau_1 + \frac{\partial G}{\partial \tau_1^*} d\tau_1^*\), and \(dG_2^* = \frac{\partial G}{\partial \tau_1} d\tau_1 + \frac{\partial G}{\partial \tau_1^*} d\tau_1^*\). Therefore, \(dG = 0\) if \(d\tau_1 = -\frac{\partial G}{\partial \tau_1} \frac{\partial G}{\partial \tau_1^*} d\tau_1^*\), and \(dG_2^* = 0\) if \(d\tau_1 = -\frac{\partial G}{\partial \tau_1} \frac{\partial G}{\partial \tau_1^*} d\tau_1^*\). Notice that these two conditions are identical. This is because \(\frac{\partial G}{\partial \tau_1} = -\frac{\partial G}{\partial \tau_1^*} \frac{\partial \tau_1}{\partial \tau_1^*} G\), \(\frac{\partial G}{\partial \tau_1^*} = \frac{\partial \tau_1}{\partial \tau_1^*} G\), \(\frac{\partial G_2^*}{\partial \tau_1} = \frac{\partial \tau_1}{\partial \tau_1^*} G\), and \(\frac{\partial G_2^*}{\partial \tau_1} = -\frac{\partial G_2^*}{\partial \tau_1} \frac{\partial G_2^*}{\partial \tau_1^*} G_2^*\) so that \(-\frac{\partial G}{\partial \tau_1} \frac{\partial G}{\partial \tau_1^*} = -\frac{\partial G_2^*}{\partial \tau_1} \frac{\partial G_2^*}{\partial \tau_1^*}\). Hence, along \(dG = dG^*_2 = 0\), \(dG_1^* = \left(\frac{\partial G_1^*}{\partial \tau_1} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial G_1^*}{\partial \tau_1^*} \frac{\partial \tau_1}{\partial \tau_1^*}ight) d\tau_1^*\). Notice that \(\frac{\partial G_1^*}{\partial \tau_1} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial G_1^*}{\partial \tau_1^*} \frac{\partial \tau_1}{\partial \tau_1^*} > 0\) for all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\). This is because \(\frac{\partial G_1^*}{\partial \tau_1} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial G_1^*}{\partial \tau_1^*} \frac{\partial \tau_1}{\partial \tau_1^*} = \frac{\partial G_1^*}{\partial \tau_1}\). Hence, there exist Pareto improving tariff changes \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\), \(d\tau_2 = d\tau_2^* = 0\), such that \(dG_1^* < 0\) and \(dG = dG^*_2 = 0\) for all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\). These \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\) are such that \(d\tau_1 < 0\) and \(d\tau_1^* < 0\) and are thus possible if and only if \(\tau_1 > 0\) and \(\tau_1^* > 0\). By symmetry, there also exist Pareto improving tariff changes \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\), \(d\tau_1 = d\tau_1^* = 0\), such that \(dG_2^* < 0\) and \(dG = dG^*_1 = 0\) for all \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\). These \((d\tau_1, d\tau_2, d\tau_1^*, d\tau_2^*)\) are such that \(d\tau_2 < 0\) and \(d\tau_2^* < 0\) and are thus possible if and only if \(\tau_2 > 0\) and \(\tau_2^* > 0\). Therefore, only \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\) such that (i) \((\tau_1, \tau_1^*) = (\text{any possible } \tau_1, 0)\) or \((\tau_1, \tau_1^*) = (0, \text{any possible } \tau_1^*)\) and (ii) \((\tau_2, \tau_2^*) = (\text{any possible } \tau_2, 0)\) or \((\tau_2, \tau_2^*) = (0, \text{any possible } \tau_2^*)\) can be Pareto efficient. It is easy to verify that for none of these \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\) there exists another \((\tau_1, \tau_2, \tau_1^*, \tau_2^*)\) which makes one country better off without making at least one of the other countries worse off. Therefore, they are also indeed Pareto efficient.
5.2.8 Proof of proposition 8

Proof. By definition, \( TB_{Mi}^* = \mu p^{1-\sigma} \left( n_1^s \phi_1^{1-\sigma} L G^{\sigma-1} - n_2^s \phi_2^{1-\sigma} L_i^s G^{\sigma-1} \right) \) so that \( TB_{Mi}^* = \frac{n_1^s \phi_1^{1-\sigma} L}{n^s + n_1^s \phi_1^{1-\sigma} + n_2^s \phi_2^{1-\sigma}} \). Also, \( \frac{n_1^s q_p}{\mu} = \frac{n_1^s \phi_1^{1-\sigma} L_i^s}{n^s + n_1^s \phi_1^{1-\sigma} + n_2^s \phi_2^{1-\sigma}} \) from manufacturing market clearing at Foreign i. Hence, \( n_i^* = \frac{\mu L^*}{q_p} + TB_{Mi}^* \) which implies that \( dn_i^* = 0 \) if and only if \( dTB_{Mi}^* = 0 \). Also, since \( n + n_1^s + n_2^s = \frac{\mu(L + L_1^s + L_2^s)}{q_p} \), \( dn = 0 \) if and only if \( dn_1^* = dn_2^* = 0 \).

Moreover, if \( d\tau_j = d\tau_j^* = dn_i = 0 \), \( \frac{dn_i^*}{d\tau_i} = \frac{(\sigma - 1) \phi_i^{1-\sigma} L_j^s \phi_j^{1-\sigma} n_i^*}{G^2(1-\sigma)} \) from Foreign j’s manufacturing market clearing condition. Also, \( \frac{L_j^s(1 - \phi_j^{1-\sigma})}{G_j^2(1-\sigma)} > \frac{L_j^s(1 - \phi_j^{1-\sigma})}{G_j^2(1-\sigma)} \) for all possible \((\tau_1, \tau_2, \tau_1^*, \tau_2^*, \tau, \tau_j)\) if and only if \( \theta > \left( \frac{L}{L + L_j^s} \right)^{\frac{1}{1-\sigma}} \) which is true because \( \theta > \left( \frac{L}{L + L_j^s} \right)^{\frac{1}{1-\sigma}} \) by assumption (c.f. appendix A1).

5.2.9 Proof of proposition 9

Proof. Recall that \( G = p \left[ n + n_1^s \phi_1^{1-\sigma} + n_2^s \phi_2^{1-\sigma} \right]^{\frac{1}{1-\sigma}}, G_1^* = p \left[ n_1^s \phi_1^{1-\sigma} + n_1^s \right]^{\frac{1}{1-\sigma}}, \) and \( G_2^* = p \left[ n_2^s \phi_2^{1-\sigma} + n_2^s \right]^{\frac{1}{1-\sigma}} \) from equations (30 - 32). Since multilaterally reciprocal tariff changes leave the number of firms unchanged in all countries, from proposition 8, multilaterally reciprocal trade liberalization therefore monotonically reduces all countries’ price indices. Since bilaterally reciprocal trade liberalization between Home and Foreign i leaves the number of firms unchanged in Foreign i but increases the number of firms at Home at the expense of Foreign j, from proposition 8, bilaterally reciprocal trade liberalization between Home and Foreign i therefore monotonically decreases the price indices of Home and Foreign i but monotonically increases the price index of Foreign j.

5.2.10 Proof of proposition 10

Proof. If tariffs are restricted to be nondiscriminatory, \( d\tau_1 = d\tau_2 \) so that purely bilateral tariff changes between Home and Foreign 1 or Home and Foreign 2 are not possible.
Hence, if tariff changes are nondiscriminatory and bilaterally reciprocal they must be bilaterally reciprocal between Home and Foreign 1 and Home and Foreign 2. Since tariff changes which are bilaterally reciprocal between Home and Foreign 1 and Home and Foreign 2 are also multilaterally reciprocal this implies that all tariff changes which are nondiscriminatory and bilaterally reciprocal must also be multilaterally reciprocal.

5.2.11 Proof of proposition 11

**Proof.** Recall that $G = p \left[ n + n_1^1 \phi_1^{1-\sigma} + n_2^2 \phi_2^{1-\sigma} \right]$ from equation (30). Since nondiscriminatory and reciprocal tariff changes leave the number of firms unchanged in all countries, from propositions 8 and 10, Home’s price index is therefore increasing in its own tariffs in the second stage.