

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

Ralph Ossa[†]

London School of Economics & Princeton University

November 1, 2007

Abstract

I develop a novel theory of GATT/WTO negotiations. This theory provides new answers to two prominent questions in the trade policy literature: First, what is the purpose of trade negotiations? And second, what is the role played by the fundamental GATT/WTO principles of reciprocity and nondiscrimination? Relative to the standard terms-of-trade theory of GATT/WTO negotiations, my theory makes two 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 relies on a production relocation externality rather than the terms-of-trade externality and therefore demonstrates that the terms-of-trade externality is not the only trade policy externality which can be internalized through GATT/WTO negotiations.

JEL classification: F12, F13

Keywords: Trade negotiations; GATT/WTO; New trade theory

*I am especially indebted to my thesis advisor Stephen Redding for providing outstanding guidance and support. Special thanks also go to Pol Antras and Gene Grossman for making my visits to Harvard University and Princeton University invaluable academic experiences. I would also like to thank David Atkin, Holger Breinlich, Arnaud Costinot, David Donaldson, Penny Goldberg, Felix Hoeffler, Miklos Koren, Marc Melitz, Frederic Robert-Nicoud, Henry Overman, Daniel Sturm, and seminar participants at the London School of Economics, Princeton University, and the Otto Beisheim School of Management for very helpful comments and discussions. The usual disclaimer applies.

[†]Princeton University, Department of Economics, International Economics Section, Fisher Hall, Princeton, NJ 08544-1021, United States; rossa@princeton.edu; +1 609 258 4815 (office) or +1 917 330 9310 (cell).

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 perhaps 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).¹ 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 imports equal across trading partners and the latter stipulates that the same tariff must be applied against all trading partners for any given traded product.²

In this paper, I develop a novel theory of GATT/WTO negotiations. This theory provides new answers to two prominent questions in the trade policy literature: First,

¹According 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 findings of Rose (2004a, 2004b) are sometimes interpreted as evidence against the effectiveness of GATT/WTO negotiations. However, recent studies of Subramanian et al. (forthcoming) and Tomz et al. (forthcoming) cast serious doubt on the robustness of these findings. Moreover, Rose’s (2004a, 2004b) results would anyway not imply that GATT/WTO negotiations are not effective but would only mean that GATT/WTO members do not benefit more from them than non-members.

²I adopt here Bagwell and Staiger’s (1999) interpretation of the rules of reciprocity and nondiscrimination which I will discuss in more detail later on.

what is the purpose of trade negotiations? And second, what is the role played by the fundamental GATT/WTO principles of reciprocity and nondiscrimination? I consider GATT/WTO negotiations in a variant of the standard Krugman (1980) ‘new trade’ model. 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 in order to reduce the domestic price index. 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 sell more thus making profits and foreign manufacturing firms 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. This then reduces the domestic price index since less of the goods consumed by domestic consumers are subject to trade costs. However, if all governments impose import tariffs in an attempt to host more of the world’s manufacturing firms, no government actually succeeds and inefficiently high tariffs prevail. 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 countries 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 negotiations which builds on the classic optimal tariff argument. Its main idea goes back to Johnson (1953-54): In a neoclassical environment, each country has an incentive to impose import tariffs in order to improve its terms-of-trade. However, if all countries impose import tariffs in an attempt to improve their terms-of-trade, no country actually succeeds and inefficiently high tariffs prevail. This inefficiency then creates incentives for cooperative trade policy setting.³ Grossman and Helpman (1995) extended this main argument to the case in which governments are subject to pressure from domestic interest groups. They demonstrated that tariffs continue to entail a terms-of-trade externality in this case which can be internalized in trade negotiations. Bagwell and Staiger (1999) built on this literature and developed a unified framework of GATT/WTO negotiations. In a very general neoclassical trade model in which governments have preferences consistent with all leading political economy approaches, they showed that the fundamental GATT/WTO principles of reciprocity and nondiscrimination can be interpreted as simple negotiation rules which help governments internalize the terms-of-trade externality. They also demonstrated that, in their very general environment, the only purpose of GATT/WTO negotiations can be to internalize the terms-of-trade externality.⁴

Relative to this standard theory, my theory makes two main contributions. First,

³See also Kuga (1973), Mayer (1981), Riezman (1982), Dixit (1987), Kennan and Riezman (1988), Maggi (1999), and Syropoulos (2002).

⁴An alternative theory of trade agreements was offered by Maggi and Rodriguez-Clare (1998). It stresses commitment considerations, pointing out that trade agreements may help governments commit vis-à-vis domestic special interest groups. It differs fundamentally both from the standard terms-of-trade theory of GATT/WTO negotiations as well as from my 'new trade' theory of GATT/WTO negotiations in that it does not view trade negotiations as a means to internalize an international trade policy externality. Maggi and Rodriguez-Clare (forthcoming) show how this commitment theory can be combined with the standard terms-of-trade theory. See also Staiger and Tabellini (1987) and Mitra (2002).

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 negotiations. Most importantly, neoclassical trade theory studies trade between different countries whereas ‘new trade’ theory investigates trade between similar countries so that a ‘new trade’ theory of GATT/WTO negotiations is perhaps better suited to understand GATT/WTO negotiations between similar countries.⁵ Second, the production relocation externality highlighted in my ‘new trade’ theory is independent of the terms-of-trade externality stressed in the standard theory. In fact, I make assumptions in my model which serve to fix world prices and thus eliminate any role for terms-of-trade effects. I thereby demonstrate that, contrary to the standard theory’s main conclusion, the terms-of-trade externality is not the only trade policy externality which can be internalized through GATT/WTO negotiations. This is especially important given that many economists doubt the real-world relevance of terms-of-trade effects. Bagwell and Staiger (2002: 181) summarize that "many economists are skeptical as to the practical relevance of terms-of-trade considerations for actual trade policy negotiations".⁶ Krugman (1997: 113), for example, argues that "this optimal tariff argument plays almost no role in real-world trade disputes".⁷ Be that as it may, I do not aim to disprove the importance of terms-of-

⁵This is not to say that terms-of-trade effects are unimportant in ‘new trade’ environments. Gros (1987), for example, demonstrated that governments also have an incentive to impose import tariffs in order to improve their terms-of-trade in a simple Krugman (1980) model.

⁶Bagwell and Staiger (2002: 181-185) argue that this is partly due to a misunderstanding of the terms-of-trade theory of GATT/WTO negotiations. Bagwell and Staiger (2006) and Broda et al. (forthcoming) provide some evidence of the real-world importance of terms-of-trade effects.

⁷See Ethier (2002) and Regan (2006) for more examples.

trade effects. Instead, I hope to strengthen the literature's most fundamental claim that economic logic can be used to make sense of GATT/WTO negotiations by providing an alternative and plausible economic explanation of GATT/WTO negotiations.⁸

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 noncooperative 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

The basic model is a variant of the standard Krugman (1980) 'new trade' model. In Krugman (1980) type environments, import tariffs can improve welfare in two ways. First, by reducing world demand for imports, thereby improving the terms-of-trade (Gros, 1987).⁹ And second, by expanding the domestic manufacturing sector, thereby

⁸In contrast, it has sometimes been suggested that the behavior of trade policy makers in GATT/WTO negotiations reflects a mercantilist attitude which is at odds with economic reasoning. See, for example, Krugman (1997).

⁹The basic principle is the same as in the neoclassical trade model. An extra twist is that a tariff can now also improve welfare by correcting the domestic distortion originating from the monopoly pricing of domestic manufacturing firms. Gros (1987) shows that therefore the optimal tariff is positive even if the country is so small that it has no market power in world markets. See also Flam and Helpman

reducing the domestic price index (Venables, 1987).¹⁰ This second channel underlies my ‘new trade’ theory of GATT/WTO negotiations. To isolate it, I follow Helpman and Krugman (1989) in developing a version of the Krugman (1980) model which does not feature terms-of-trade effects.

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

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

$$U^* = \left[\int_0^{n+n^*} m^*(j)^{\frac{\sigma-1}{\sigma}} dj \right]^{\frac{\mu\sigma}{\sigma-1}} Y^{*1-\mu}, \quad \sigma > 1 \quad (2)$$

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, σ is the elasticity of substitution between manufacturing goods, and μ 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

$$l^M = f + cq^M \quad (3)$$

$$l^{*M} = f + cq^{*M} \quad (4)$$

(1987) and Helpman and Krugman (1989).

¹⁰I explain this ‘Venables effect’ in detail later on. See Helpman and Krugman (1989) for an extensive discussion of trade policy in Krugman (1980) and other ‘new trade’ models.

$$l^Y = q^Y \tag{5}$$

$$l^{*Y} = q^{*Y} \tag{6}$$

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 apply only to manufacturing goods and are of the Samuelson (1952) ‘iceberg’ type. In particular, for one unit of a manufacturing good to arrive in the other country, ϕ units must be shipped and the remainder ‘melts away’ in transit. These iceberg trade costs ϕ are further decomposed into transport costs θ , which are identical across countries, and trade barriers τ , which may be different across countries. These trade barriers are policy instruments and the key variables of the analysis. For concreteness, I refer to them as tariffs in the following but they can really reflect any policy-induced impediment to trade.¹¹ I also restrict $\tau < \bar{\tau}$, where $\bar{\tau}$ is some arbitrarily large but finite upper bound. This finite upper bound is purely introduced for technical convenience. Removing it would somewhat complicate the exposition without changing the results in any interesting way (see appendix A1 for a detailed discussion of this). Hence,

$$\phi = \theta + \tau, \quad \theta > 1, \bar{\tau} \geq \tau \geq 0 \tag{7}$$

$$\phi^* = \theta + \tau^*, \quad \theta > 1, \bar{\tau} \geq \tau^* \geq 0 \tag{8}$$

Finally, I also make the following two additional assumptions: First, I assume that the manufacturing sector is always active in both countries. This requires transport costs to be sufficiently large (see appendix A2 for the precise parameter restriction on

¹¹One particularity of tariffs relative to other trade barriers is that they also generate tariff revenue. However, tariff revenue plays no role in the mechanism isolated here so that it seems cleaner to focus on ‘iceberg’ trade barriers instead.

θ). Second, I assume that the outside good sector is always active in both countries. This requires the demand for manufacturing goods to be sufficiently small (see again appendix A2 for the precise parameter restriction on μ). The former assumption is made purely for simplicity. It ensures that countries can never attract all manufacturing firms through trade policy and thereby eliminates corner solutions. The latter assumption ensures, together with the assumptions made on outside good technology, market structure, and trade costs, that there is no role for terms-of-trade effects in this environment. I comment further on this latter point below.

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

$$Y = (1 - \mu) L \quad (9)$$

$$Y^* = (1 - \mu) L^* \quad (10)$$

and the following demands for each manufacturing good

$$m(i) + m^*(i) = \mu L \frac{p(i)^{-\sigma}}{G^{1-\sigma}} + \mu L^* \phi^{*1-\sigma} \frac{p(i)^{-\sigma}}{G^{*1-\sigma}} \quad (11)$$

$$m(j) + m^*(j) = \mu L \phi^{1-\sigma} \frac{p^*(j)^{-\sigma}}{G^{1-\sigma}} + \mu L^* \frac{p^*(j)^{-\sigma}}{G^{*1-\sigma}} \quad (12)$$

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

$$G = \left[\int_0^n p(i)^{1-\sigma} di + \int_0^{n^*} [\phi p^*(j)]^{1-\sigma} dj \right]^{\frac{1}{1-\sigma}} \quad (13)$$

$$G^* = \left[\int_0^n [\phi^* p(i)]^{1-\sigma} di + \int_0^{n^*} p^*(j)^{1-\sigma} dj \right]^{\frac{1}{1-\sigma}} \quad (14)$$

Since these manufacturing demand functions have a constant price elasticity of σ , profit-maximization implies that manufacturing firms charge a constant mark-up over marginal costs so that

$$p(i) = p^*(j) = \frac{\sigma c}{\sigma - 1} \equiv p \quad (15)$$

which implies that the price indices simplify to

$$G = p [n + n^* \phi^{1-\sigma}]^{\frac{1}{1-\sigma}} \quad (16)$$

$$G^* = p [n \phi^{*1-\sigma} + n^*]^{\frac{1}{1-\sigma}} \quad (17)$$

Free entry drives manufacturing firms' profits down to zero leading to the following break-even outputs

$$q = q^* = \frac{f(\sigma - 1)}{c} \quad (18)$$

and hence the following break-even labor demands

$$l = l^* = f\sigma \quad (19)$$

Manufacturing market clearing thus requires

$$q = \mu L \frac{p^{-\sigma}}{G^{1-\sigma}} + \mu L^* \frac{\phi^{*1-\sigma} p^{-\sigma}}{G^{*1-\sigma}} \quad (20)$$

$$q = \mu L \frac{\phi^{1-\sigma} p^{-\sigma}}{G^{1-\sigma}} + \mu L^* \frac{p^{-\sigma}}{G^{*1-\sigma}} \quad (21)$$

These manufacturing market clearing conditions can be solved for the equilibrium price indices

$$G = \left[\frac{qp^\sigma (1 - \phi^{1-\sigma})}{\mu L [1 - (\phi\phi^*)^{1-\sigma}]} \right]^{\frac{1}{\sigma-1}} \quad (22)$$

$$G^* = \left[\frac{qp^\sigma (1 - \phi^{1-\sigma})}{\mu L^* [1 - (\phi\phi^*)^{1-\sigma}]} \right]^{\frac{1}{\sigma-1}} \quad (23)$$

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

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

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

Notice that this implies that the world number of manufacturing firms is always constant and given by¹²

$$n + n^* = \frac{\mu(L + L^*)}{qp} \quad (26)$$

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

$$V = \mu^\mu (1 - \mu)^{(1-\mu)} LG^{-\mu} \quad (27)$$

$$V^* = \mu^\mu (1 - \mu)^{(1-\mu)} L^* G^{*-\mu} \quad (28)$$

so that each country's welfare is decreasing in its manufacturing price index. Notice finally that, from equation (15), world prices are fixed in this environment so that there

¹²This 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. It is in no way essential for the analysis but serves to neatly illustrate the tariff-induced production relocation effect which underlies this 'new trade' theory of GATT/WTO negotiations.

can be no role for terms-of-trade effects.¹³ 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 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 business location for manufacturing firms. 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 sell

¹³I follow Helpman and Krugman (1989: 143) in defining Home's terms-of-trade as $\frac{p}{p^*}$. One may object that this is a too narrow definition since terms-of-trade effects should really operate through price indices in this environment. I show below that, even if such a wider definition is adopted, my results can still not be reinterpreted as terms-of-trade effects.

more thus making profits and foreign manufacturing firms 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 business location for manufacturing firms eventually needs to be counterbalanced by increased domestic competition, i.e. a lower domestic price index. To see this more clearly, consider 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 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 1:¹⁴

Proposition 1 *Suppose governments choose tariffs simultaneously, Home maximizing V and Foreign maximizing V^* . Then the unique Nash equilibrium tariff combination is*

$$(\tau, \tau^*) = (\bar{\tau}, \bar{\tau})$$

¹⁴Even if Home's terms-of-trade are not defined as $\frac{p}{p^*}$ but instead in terms of price indices, the effect of a tariff in this model still cannot be reinterpreted as a terms-of-trade effect. To see this, recall that $G^{1-\sigma} = p^{1-\sigma}n + (p\phi)^{1-\sigma}n^*$ and $G^{*1-\sigma} = (p\phi^*)^{1-\sigma}n + p^{1-\sigma}n^*$ from equations (16) and (17). It is therefore natural to define G_{exp} as a world price index of Home's manufacturing exports and G_{imp} as a world price index of Home's manufacturing imports, where $G_{\text{exp}}^{1-\sigma} = p^{1-\sigma}n$ and $G_{\text{imp}}^{1-\sigma} = p^{1-\sigma}n^*$. In terms of these world price indices, Home's terms-of-trade are then given by $\frac{G_{\text{exp}}}{G_{\text{imp}}} = \left(\frac{n}{n^*}\right)^{\frac{1}{1-\sigma}}$. Since this ratio is actually *decreasing* rather than *increasing* in Home's tariff because Home gains manufacturing firms at Foreign's expense, the tariff's effect can therefore not be reinterpreted as a terms-of-trade *gain* even using this wider definition of Home's terms-of-trade.

Proof. See appendix A3 ■

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 (τ, τ^*) such that $(\tau, \tau^*) = (\text{any possible } \tau, 0)$ or $(\tau, \tau^*) = (0, \text{any possible } \tau^*)$*

Proof. See appendix A3 ■

Corollary 1 *The trade war equilibrium tariffs $(\tau, \tau^*) = (\bar{\tau}, \bar{\tau})$ 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:¹⁵ Generally speaking, reciprocity requires that

¹⁵For a discussion of how this interpretation is obtained, see chapter 3 of Bagwell and Staiger (2002).

trade policy changes keep changes in imports 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, 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:

Definition 1 *Define a tariff change $(d\tau, d\tau^*)$ to be reciprocal if it is such that $dTB_M = 0$, where $TB_M \equiv EXP_M - IMP_M$ 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. It can be shown that the number of manufacturing firms operating at Home

can be decomposed as follows:¹⁶

$$n = \frac{\mu L}{qp} + \frac{TB_M}{qp} \quad (29)$$

The first term is the number of manufacturing firms Home would have under autarky. The second term is the additional number of firms required to satisfy the net demand from Foreign. This is because μL is Home's expenditure on manufacturing goods, TB_M 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.¹⁷ 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 A3 ■

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

¹⁶For details see the proof to proposition 3.

¹⁷This discussion is related to the analysis of Baldwin and Robert-Nicoud (2000) who study Venables (1987) type trade policy effects in an economic geography model developed by Martin and Rogers (1995). They show that symmetric liberalization between asymmetric countries leads to international firm relocations from the small to the large country. They also show that the large country needs to liberalize faster than the small country if international firm relocations are to be prevented. See also Baldwin et al. (2003).

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 A3 ■

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 a country responds reciprocally to any tariff increase of the other country, 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 further 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 responds reciprocally to any unilateral tariff increase by Home. Then, Home never deviates from the cooperative agreement in the second stage*

Proof. See appendix A3 ■

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.¹⁸ The notation is a straightforward generalization of the one used before. For example, τ_1 is now the tariff imposed by Home against imports from Foreign 1, τ_2^* is now the tariff imposed by Foreign 2 against imports from Home, and G_1^* 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

$$G = p \left[n + n_1^* \phi_1^{1-\sigma} + n_2^* \phi_2^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \quad (30)$$

$$G_1^* = p \left[n \phi_1^{*1-\sigma} + n_1^* \right]^{\frac{1}{1-\sigma}} \quad (31)$$

¹⁸One 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 again be found in appendix A2.

$$G_2^* = p [n\phi_2^{*1-\sigma} + n_2^*]^{\frac{1}{1-\sigma}} \quad (32)$$

Manufacturing market clearing requires

$$q = \mu L \frac{p^{-\sigma}}{G^{1-\sigma}} + \mu L_1^* \phi_1^{*1-\sigma} \frac{p^{-\sigma}}{G_1^{*1-\sigma}} + \mu L_2^* \phi_2^{*1-\sigma} \frac{p^{-\sigma}}{G_2^{*1-\sigma}} \quad (33)$$

$$q = \mu L \phi_1^{1-\sigma} \frac{p^{-\sigma}}{G^{1-\sigma}} + \mu L_1^* \frac{p^{-\sigma}}{G_1^{*1-\sigma}} \quad (34)$$

$$q = \mu L \phi_2^{1-\sigma} \frac{p^{-\sigma}}{G^{1-\sigma}} + \mu L_2^* \frac{p^{-\sigma}}{G_2^{*1-\sigma}} \quad (35)$$

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

$$\Phi \equiv 1 - \phi_1^{*1-\sigma} - \phi_2^{*1-\sigma} \quad (36)$$

$$\Phi_1 \equiv 1 - \phi_1^{1-\sigma} - \phi_2^{*1-\sigma} (\phi_2^{1-\sigma} - \phi_1^{1-\sigma}) \quad (37)$$

$$\Phi_2 \equiv 1 - \phi_2^{1-\sigma} - \phi_1^{*1-\sigma} (\phi_1^{1-\sigma} - \phi_2^{1-\sigma}) \quad (38)$$

$$\Omega \equiv 1 - (\phi_1 \phi_1^*)^{1-\sigma} - (\phi_2 \phi_2^*)^{1-\sigma} \quad (39)$$

they can be written as

$$G = \left[\frac{qp^\sigma \Phi}{\mu L \Omega} \right]^{\frac{1}{\sigma-1}} \quad (40)$$

$$G_1^* = \left[\frac{qp^\sigma \Phi_1}{\mu L_1^* \Omega} \right]^{\frac{1}{\sigma-1}} \quad (41)$$

$$G_2^* = \left[\frac{qp^\sigma \Phi_2}{\mu L_2^* \Omega} \right]^{\frac{1}{\sigma-1}} \quad (42)$$

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

$$n = \frac{\mu}{qp} \left[\frac{L}{\Phi} - \frac{L_1^* \phi_1^{1-\sigma}}{\Phi_1} - \frac{L_2^* \phi_2^{1-\sigma}}{\Phi_2} \right] \quad (43)$$

$$n_1^* = \frac{\mu}{qp} \left[\frac{L_1^* [1 - (\phi_2 \phi_2^*)^{1-\sigma}]}{\Phi_1} + \frac{L_2^* (\phi_1^* \phi_2^*)^{1-\sigma}}{\Phi_2} - \frac{L \phi_1^{*1-\sigma}}{\Phi} \right] \quad (44)$$

$$n_2^* = \frac{\mu}{qp} \left[\frac{L_2^* [1 - (\phi_1 \phi_1^*)^{1-\sigma}]}{\Phi_2} + \frac{L_1^* (\phi_1 \phi_2^*)^{1-\sigma}}{\Phi_1} - \frac{L \phi_2^{*1-\sigma}}{\Phi} \right] \quad (45)$$

These expressions again imply that the world number of manufacturing firms is constant.

Since there are now three countries, it is given by

$$n + n_1^* + n_2^* = \frac{\mu(L + L_1^* + L_2^*)}{qp} \quad (46)$$

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 equilibrium tariff combination is $(\tau_1, \tau_2, \tau_1^*, \tau_2^*) = (\bar{\tau}, \bar{\tau}, \bar{\tau}, \bar{\tau})$*

Proof. See appendix A3 ■

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 A3 ■

Corollary 2 *The trade war equilibrium tariffs $(\tau_1, \tau_2, \tau_1^*, \tau_2^*) = (\bar{\tau}, \bar{\tau}, \bar{\tau}, \bar{\tau})$ 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 a more attractive business location for manufacturing firms. 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 equi-

librium 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 multilateral trade negotiations, where bilateral and multilateral tariff changes are formally defined as follows:

Definition 2 *Define a tariff change $(d\tau_i, d\tau_i^*)$ to be bilaterally reciprocal between Home and Foreign i if it is such that $dTB_{Mi}^* = 0$, where $TB_{Mi}^* \equiv EXP_{Mi}^* - IMP_{Mi}^*$ 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:¹⁹

$$n_i^* = \frac{\mu L_i^*}{qp} + \frac{TB_{Mi}^*}{qp} \quad (47)$$

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 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 A3 ■

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

¹⁹Details can again be found in appendix A3.

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 A3 ■

Notice third that the principle of nondiscrimination is a simple way to ‘multilateralize’ the principle of reciprocity.²⁰ 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 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 A3 ■

Observe finally that under reciprocity and nondiscrimination all negotiated tariff concessions are secured by guaranteeing that no country has an incentive to reverse

²⁰Notice 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.

them. If Foreign 1 and Foreign 2 respond reciprocally to any tariff increase by Home above the negotiated tariff levels, then Home no longer has an incentive to increase its tariff. 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 11:²¹

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 respond reciprocally to any unilateral tariff increase by Home. Then Home never deviates from the cooperative agreement in the second stage*

Proof. See appendix A3 ■

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.

²¹Notice 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 come back to this point in the section on free trade agreements.

3.5 Free trade agreements

GATT/WTO articles allow countries to sign free trade agreements as an important exception to the principle of reciprocity. Given that this principle is one of the two fundamental pillars of the GATT/WTO system, this has raised concerns that free trade agreements could undermine multilateral trade negotiations.²² Bagwell and Staiger's (1999) analysis strengthens these concerns. In their model, free trade agreements pose a major threat to the functioning of GATT/WTO negotiations in the sense that they eliminate the possibility to implement efficient trade agreements. In this section, I revisit these concerns in the context of my 'new trade' theory.

Suppose thus that Home and Foreign 1 sign a free trade agreement so that $\tau_1 = \tau_1^* = 0$. Will reciprocal trade negotiations between Home and Foreign 2 still guide countries to the efficiency frontier? It should be clear from the discussion in the previous sections that this is indeed the case. Basically, Home and Foreign 2 can both improve their welfare monotonically if they liberalize in a bilaterally reciprocal way. This is because bilateral reciprocity eliminates the bilateral firm relocation effect and Home gains at the expense of Foreign 1 due to the multilateral firm relocation effect. Such bilaterally reciprocal liberalization can continue until $\tau_2 = 0$ and/or $\tau_2^* = 0$ which, together with the fact that $\tau_1 = \tau_1^* = 0$, implies that efficient tariffs will be reached. For the same reasons, neither Home nor Foreign 2 has an incentive to deviate from such efficient tariffs so that the principle of reciprocity also secures efficient tariffs.

Of course, welfare no longer improves monotonically in all countries during the liberalization process. If Home and Foreign 1 both gain from a free trade agreement, Foreign 2 loses due to the multilateral firm relocation effect. And if Home and Foreign 2 then liberalize in a bilaterally reciprocal way, Foreign 1 loses due to the multilateral firm relocation effect. This highlights the fundamental role of nondiscrimination in this en-

²²More generally, the debate is whether preferential trade agreements are 'building blocs' or 'stumbling blocs' on the way to multilateral free trade. See Panagariya (2000) for a comprehensive survey of the literature. See also Antras et al. (2007) for an interesting recent contribution to this literature.

vironment: To multilateralize trade negotiations in order to ensure that no government can gain at another government's expense.

4 Conclusion

In this paper, I developed a 'new trade' theory of GATT/WTO negotiations. I first demonstrated that tariffs are inefficiently high in the noncooperative equilibrium since trade policy entails an international production relocation externality. I then showed that GATT/WTO negotiations governed by the principles of reciprocity and nondiscrimination help countries overcome this inefficiency by making them internalize this externality.

Notice that this 'new trade' theory builds on a rationale for unilateral protection which can be linked directly to trade policy debates. In the model, the higher the import tariff, the larger is the number of domestic manufacturing firms; the larger the number of domestic manufacturing firms, the lower is the domestic price index; and the lower the domestic price index, the higher is domestic welfare. Therefore, while trade policymakers are assumed to maximize domestic welfare in the model, their tariff choices are exactly as if they maximized the number of domestic manufacturing firms. And since the number of domestic manufacturing firms translates directly into the number of domestic manufacturing jobs, this is equivalent to maximizing the number of domestic manufacturing jobs. In the model, a unilateral import tariff also improves the market access of domestic manufacturing firms. This is because a higher tariff only leads to entry in the domestic manufacturing sector because it increases the sales of domestic manufacturing firms.²³

²³Following Redding and Venables (2004), the market access available to Home manufacturing firms can be defined as $MA = \frac{\mu L}{G^{1-\sigma}} + \frac{\mu L^* \phi^{*1-\sigma}}{G^{*1-\sigma}}$. As is clear from equation (20), market access then simply captures the position of the demand curve facing Home manufacturing firms. It consists of domestic market access, $DMA = \frac{\mu L}{G^{1-\sigma}}$, and foreign market access, $FMA = \frac{\mu L^* \phi^{*1-\sigma}}{G^{*1-\sigma}}$. A unilateral import tariff imposed by Home initially increases MA by increasing DMA because of the import price effect. Of course, DMA and FMA then adjust so that MA returns to its original level because of the production

While I thus hope to provide a plausible alternative to the standard neoclassical theory of GATT/WTO negotiations, a more rigorous empirical assessment of its relative importance is left for future work. A starting point could be the following distinct empirical prediction: Consider reciprocal trade liberalization between two asymmetric countries. In the neoclassical model, the principle of reciprocity keeps the terms-of-trade unchanged as shown by Bagwell and Staiger (1999). As a consequence, the large country should cut tariffs more slowly during reciprocal trade liberalization. This is because the large country has a stronger effect on the terms-of-trade because it has more market power in world markets. In the ‘new trade’ model, the principle reciprocity instead keeps the manufacturing trade balance unchanged. Therefore, the large country should cut tariffs more rapidly during reciprocal trade liberalization. This is because relative country size matters more for the location of manufacturing production the lower are trade costs. A simple illustrative example of this can be obtained by comparing autarky to free trade. Under autarky, the manufacturing trade balance is zero whereas under free trade the large country is a net exporter of manufacturing goods due to the home market effect suggesting that the large country should indeed liberalize more rapidly in order to keep the manufacturing trade balance unchanged.²⁴

Besides, the analysis can also be extended theoretically in many interesting ways. For example, one could integrate the neoclassical theory of GATT/WTO negotiations and the ‘new trade’ theory of GATT/WTO negotiations into a unified framework. Helpman and Krugman’s (1985) synthesis of neoclassical and ‘new trade’ theory may be a fruitful starting point for such research. Furthermore, one could introduce political economy forces into the model to see how they shape trade negotiations in this ‘new trade’ environment. Such work could build on Chang (2005) who considers Grossman and Helpman (1994) type lobbying in the context of a Krugman (1980) model.

relocation effect.

²⁴It is easy to verify that $TB_M \rightarrow 0$ as $(\tau, \tau^*) \rightarrow (\infty, \infty)$ and that $TB_M > 0$ at $(\tau, \tau^*) = (0, 0)$ if and only if $L > L^*$. The fact that relative country size matters more for the location of manufacturing production the lower are trade costs is sometimes referred to as home market magnification effect.

References

- [1] Antras, P., Aghion, P., Helpman, E., 2007. Negotiating free trade. *Journal of International Economics* 73, 1-30.
- [2] Bagwell, K, Staiger, R.W., 1999. An economic theory of GATT. *American Economic Review* 89, 215-248.
- [3] Bagwell, K, Staiger, R.W., 2002. *The economics of the world trading system*. The MIT Press, Cambridge.
- [4] Bagwell, K, Staiger, R.W., 2006. What do trade negotiators negotiate about? Empirical evidence from the World Trade Organization. NBER Working Paper 12727.
- [5] Baldwin, R.E., Robert-Nicoud, F., 2000. Free trade agreements without delocation. *Canadian Journal of Economics* 33, 766-786.
- [6] Baldwin, R.E., Forslid, R., Martin, P., Ottaviano, G., Robert-Nicoud, F., 2003. *Economic geography and public policy*. Princeton University Press, Princeton.
- [7] Broda, C., Limao, N., Weinstein, D.E., forthcoming. Optimal tariffs: The evidence. *American Economic Review*.
- [8] Chang, P., 2005. Protection for sale under monopolistic competition. *Journal of International Economics* 66, 509-526.
- [9] Dixit, A., 1987. Strategic aspects of trade policy, in: Bewley, T.F. (Ed.), *Advances in economic theory: Fifth world congress*. Cambridge University Press, Cambridge.
- [10] Ethier, W.J., 2002. Political externalities, nondiscrimination, and a multilateral world. PIER Working Paper 02-030. University of Pennsylvania.

- [11] Gros, D., 1987. A note on the optimal tariff, retaliation and the welfare loss from tariff wars in a framework with intra-industry trade. *Journal of International Economics* 23, 357-367.
- [12] Flam, H., Helpman, E., 1987. Industrial policy under monopolistic competition. *Journal of International Economics* 22, 79-102.
- [13] Grossman, G., Helpman, E., 1994. Protection for sale. *American Economic Review* 84, 833-850.
- [14] Grossman, G., Helpman, E., 1995. Trade wars and trade talks. *Journal of Political Economy* 103, 675-708.
- [15] Helpman, E., Krugman, P., 1985. *Market structure and foreign trade*. The MIT Press, Cambridge.
- [16] Helpman, E., Krugman, P., 1989. *Trade policy and market structure*. The MIT Press, Cambridge.
- [17] Johnson, H.G., 1953-1954. Optimum tariffs and retaliation. *Review of Economic Studies* 21, 142-53.
- [18] Keohane, R.O., 1988. International institutions: Two approaches. *International Studies Quarterly* 32. 379-396.
- [19] Kennan, J., Riezman, R., 1988. Do big countries win tariff wars? *International Economic Review* 29, 81-85.
- [20] Krugman, P., 1980. Scale economies, product differentiation, and the pattern of trade. *American Economic Review* 70, 950-959.
- [21] Krugman, P., 1997. What should trade negotiators negotiate about? *Review of Economic Literature* 35, 113-120.

- [22] Kuga, K., 1973. Tariff retaliation and policy equilibrium. *Journal of International Economics* 3, 351-366.
- [23] Maggi, G., 1999. The role of multilateral institutions in international trade cooperation. *American Economic Review* 89, 190-214.
- [24] Maggi, G., Rodriguez-Clare, A., 1998. The value of trade agreements in the presence of political pressures. *Journal of Political Economy* 106, 574-601.
- [25] Maggi, G., Rodriguez-Clare, A., forthcoming. A political-economy theory of trade agreements. *American Economic Review*.
- [26] Martin, P., Rogers, C., 1995. Industrial location and public infrastructure. *Journal of International Economics* 39, 335-351.
- [27] Mayer, W., 1981. Theoretical considerations on negotiated tariff adjustments. *Oxford Economic Papers* 33, 135-53.
- [28] Mitra, D., 2002. Endogenous political organization and the value of trade agreements. *Journal of International Economics* 57, 473-485.
- [29] Panagariya, A., 2000. Preferential trade liberalization: The traditional theory and new developments. *Journal of Economic Literature* 38, 287-331.
- [30] Redding, S., Venables, A.J., 2004. Economic geography and international inequality. *Journal of International Economics* 62, 53-82.
- [31] Regan, D., 2006. What are trade agreements for? Two conflicting stories told by economists, with a lesson for lawyers. *Journal of International Economic Law* 9, 951-988.
- [32] Riezman, R., 1982. Tariff retaliation from a strategic viewpoint. *Southern Economic Journal* 48, 583-593.

- [33] Rose, A., 2004a. Do we really know that the WTO increases trade? *American Economic Review* 94, 98-114.
- [34] Rose, A., 2004b. Do WTO members have more liberal trade policy? *Journal of International Economics* 63, 209-235.
- [35] Samuelson, P., 1952. The transfer problem and transport costs: The terms-of-trade when impediments are absent. *Economic Journal* 62, 278-304.
- [36] Staiger, R.W., Tabellini, G., 1987. Discretionary trade policy and excessive protection. *American Economic Review* 77, 823-837.
- [37] Subramanian, A., Shang-Jin, W., 2007. The WTO promotes trade, strongly but unevenly. *Journal of International Economics* 72, 151-175.
- [38] Syropoulos, C., 2002. Optimum tariffs and retaliation revisited: How country size matters. *Review of Economics Studies* 69, 707-727.
- [39] Tomsz, M., Goldstein, J., Rivers, D., forthcoming. Membership has its privileges: The impact of GATT on international trade. *American Economic Review*.
- [40] Venables, A.J., 1987. Trade and trade policy with differentiated products: A Chamberlinian-Ricardian model. *The Economic Journal* 97, 700-717.

5 Appendix

5.1 Appendix A1: Effects of allowing $\bar{\tau} \rightarrow \infty$

If $\bar{\tau} \rightarrow \infty$, propositions 1, 6, 8, and 9 would have to be modified as follows:

Effect on proposition 1: If $\bar{\tau} \rightarrow \infty$, $(\bar{\tau}, \bar{\tau})$ would no longer be the unique Nash equilibrium tariff combination but instead the unique trembling-hand perfect Nash equilibrium tariff combination. In particular, $\frac{\partial G}{\partial \tau} \rightarrow 0$ if $\tau^* \rightarrow \infty$ and $\frac{\partial G^*}{\partial \tau^*} \rightarrow 0$ if $\tau \rightarrow \infty$ as can be seen from equations (22) and (23). Therefore, all (τ, τ^*) such that $(\tau, \tau^*) = (\text{any } \tau, \bar{\tau})$ or $(\tau, \tau^*) = (\bar{\tau}, \text{any } \tau^*)$ would be Nash equilibrium tariff combinations if $\bar{\tau} \rightarrow \infty$. However, only $(\bar{\tau}, \bar{\tau})$ would be robust to small perturbations in the governments' strategies because $\frac{\partial G}{\partial \tau} < 0$ as soon as $\tau^* < \infty$ and $\frac{\partial G^*}{\partial \tau^*} < 0$ as soon as $\tau < \infty$.

Effect on proposition 6: This is analogous to the effect on proposition 1. If $\bar{\tau} \rightarrow \infty$, $(\bar{\tau}, \bar{\tau}, \bar{\tau}, \bar{\tau})$ would no longer be the unique Nash equilibrium tariff combination but instead the unique trembling-hand perfect Nash equilibrium tariff combination since all other Nash equilibrium tariff combinations would not be robust to small perturbations in the governments' strategies.

Effect on proposition 8: If $\bar{\tau} \rightarrow \infty$, the statement on the effect of bilaterally reciprocal trade liberalization (trade protection) between Home and Foreign i on Foreign j would have to be qualified. In particular, bilaterally reciprocal trade liberalization (trade protection) between Home and Foreign i would then increase (decrease) the number of firms in Foreign j if $\tau_j < \infty$ and leave the number of firms unchanged in Foreign j if $\tau_j \rightarrow \infty$. This is because $\frac{\partial G_j^*}{\partial \tau_i} = \frac{\partial G_j^*}{\partial \tau_i^*} = 0$ if $\tau_j \rightarrow \infty$, as can be seen from equations (41) and (42).

Effect on proposition 9: This follows directly from the effect on proposition 8. If $\bar{\tau} \rightarrow \infty$, the statement on the effect of bilaterally reciprocal trade liberalization between Home and Foreign i on Foreign j would have to be qualified. In particular, bilaterally

reciprocal trade liberalization between Home and Foreign i would then monotonically decrease the welfare in Foreign j if $\tau_j < \infty$ and leave the welfare unchanged in Foreign j if $\tau_j \rightarrow \infty$. This would imply that, starting at the noncooperative equilibrium, reciprocal trade liberalization between Home and Foreign i would leave welfare unaffected in Foreign j . However, any subsequent bilaterally reciprocal trade liberalization between Home and Foreign j would then still monotonically decrease welfare in Foreign i so that the multilateral production relocation effect would still have to be neutralized in order to eliminate all trade policy externalities.

5.2 A2: Parameter restrictions

5.2.1 Two-country model

The equilibrium number of manufacturing firms operating at Home is given by $n = \frac{\mu}{qp} \left[\frac{L}{1-\phi^{1-\sigma}} - \frac{L^*\phi^{1-\sigma}}{1-\phi^{1-\sigma}} \right]$ from equation (24). Hence, the maximum value n can take for all $(\tau, \tau^*, \bar{\tau})$ is $n_{\max} = \frac{\mu}{qp} \left[\frac{L}{1-\theta^{1-\sigma}} \right]$ and the minimum value n can take for all $(\tau, \tau^*, \bar{\tau})$ is $n_{\min} = \frac{\mu}{qp} \left[L - \frac{L^*\theta^{1-\sigma}}{1-\theta^{1-\sigma}} \right]$. By symmetry, $n_{\max}^* = \frac{\mu}{qp} \left[\frac{L^*}{1-\theta^{1-\sigma}} \right]$ and $n_{\min}^* = \frac{\mu}{qp} \left[L^* - \frac{L\theta^{1-\sigma}}{1-\theta^{1-\sigma}} \right]$. Therefore, the manufacturing sector is always active in both countries for all $(\tau, \tau^*, \bar{\tau})$ if and only if $n_{\min} > 0$ and $n_{\min}^* > 0 \iff \theta > \left[\frac{\min(L, L^*)}{L+L^*} \right]^{\frac{1}{1-\sigma}}$. Notice that this condition reduces to $\theta > \left(\frac{1}{2}\right)^{\frac{1}{1-\sigma}}$ if $L = L^*$. Also, 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_{\max} and Foreign is large enough to fit n_{\max}^* . This is the case if $n_{\max}l < L$ and $n_{\max}^*l < L^* \iff \mu < 1 - \theta^{1-\sigma}$. Notice that this condition reduces to $\mu < \frac{1}{2}$ if $\theta = \left(\frac{1}{2}\right)^{\frac{1}{1-\sigma}}$.

5.2.2 Three-country model

The equilibrium number of manufacturing firms operating at Home is given by $n = \frac{\mu}{qp} \left[\frac{L}{\Phi} - \frac{L_1^*\phi_1^{1-\sigma}}{\Phi_1} - \frac{L_2^*\phi_2^{1-\sigma}}{\Phi_2} \right]$ from equation (43). Hence, the maximum value n can take for all $(\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})$ is $n_{\max} = \frac{\mu}{qp} \left[\frac{L}{1-2\theta^{1-\sigma}} \right]$ and the minimum value n can take for all

$(\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})$ is $n_{\min} = \frac{\mu}{qp} \left[L - \frac{L_1^* \theta^{1-\sigma}}{1-\theta^{1-\sigma}} - \frac{L_2^* \theta^{1-\sigma}}{1-\theta^{1-\sigma}} \right]$. The equilibrium number of manufacturing firms operating at Foreign i is given by $n_i^* = \frac{\mu}{qp} \left[\frac{L_i^* [1 - (\phi_j \phi_j^*)^{1-\sigma}]}{\Phi_i} + \frac{L_j^* (\phi_i^* \phi_j)^{1-\sigma}}{\Phi_j} - \frac{L \phi_i^{*1-\sigma}}{\Phi} \right]$ 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 $n_{i \max}^* = \frac{\mu}{qp} \left[\frac{L_i^*}{1-\theta^{1-\sigma}} \right]$ and the minimum value n can take for all $(\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})$ is $n_{i \min}^* = \frac{\mu}{qp} \left[L_i^* - \frac{L \theta^{1-\sigma}}{1-2\theta^{1-\sigma}} \right]$. Therefore, 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 $n_{\min} > 0$ and $n_{1 \min}^* > 0$ and $n_{2 \min}^* > 0 \iff \theta > \left(\frac{L}{L+L_1^*+L_2^*} \right)^{\frac{1}{1-\sigma}}$ and $\theta > \left(\frac{L_1^*}{L+2L_1^*} \right)^{\frac{1}{1-\sigma}}$ and $\theta > \left(\frac{L_2^*}{L+2L_2^*} \right)^{\frac{1}{1-\sigma}}$. Notice that this condition reduces to $\theta > \left(\frac{1}{3} \right)^{\frac{1}{1-\sigma}}$ if $L = L_1^* = L_2^*$. Also, 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_{\max} Foreign 1 is large enough to fit $n_{1 \max}^*$, and Foreign 2 is large enough to fit $n_{2 \max}^*$. This is the case if $n_{\max} l < L$ and $n_{1 \max}^* l < L_1^*$ and $n_{2 \max}^* l < L_2^* \iff \mu < 1 - 2\theta^{1-\sigma}$. Notice that this reduces to $\mu < \frac{1}{3}$ if $\theta = \left(\frac{1}{3} \right)^{\frac{1}{1-\sigma}}$.

5.3 A3: Proofs

5.3.1 Proof of proposition 1

Proof. Given the form of V , V is maximized when G is minimized. Also, $\frac{\partial G}{\partial \tau} = -\frac{\phi^* (\phi \phi^*)^{-\sigma}}{[1 - (\phi \phi^*)^{1-\sigma}]} G$ so that $\frac{\partial G}{\partial \tau} < 0$ for all possible (τ, τ^*) . 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 ■

5.3.2 Proof of proposition 2

Proof. A tariff combination (τ, τ^*) cannot be Pareto efficient if there exist possible Pareto improving tariff changes $(d\tau, d\tau^*)$ at (τ, τ^*) . 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 $d\tau = -\frac{\partial \tau}{\partial G} \frac{\partial G}{\partial \tau^*} d\tau^*$ so that $dG^* = \left(\frac{\partial G^*}{\partial \tau} - \frac{\partial G^*}{\partial \tau} \frac{\partial \tau}{\partial G} \frac{\partial G}{\partial \tau^*} \right) d\tau^*$ along $dG = 0$. Notice that $\frac{\partial G^*}{\partial \tau} - \frac{\partial G^*}{\partial \tau} \frac{\partial \tau}{\partial G} \frac{\partial G}{\partial \tau^*} > 0$

for all (τ, τ^*) . This is because $\frac{\partial G}{\partial \tau} = -\frac{(\phi\phi^*)^{-\sigma}\phi^*}{1-(\phi\phi^*)^{1-\sigma}}G$, $\frac{\partial G}{\partial \tau^*} = \frac{(1-\phi^{1-\sigma})\phi^{*\sigma}}{(1-\phi^{*1-\sigma})[1-(\phi\phi^*)^{1-\sigma}]}G$, $\frac{\partial G^*}{\partial \tau} = \frac{(1-\phi^{*1-\sigma})\phi^{-\sigma}}{(1-\phi^{1-\sigma})[1-(\phi\phi^*)^{1-\sigma}]}G^*$, and $\frac{\partial G^*}{\partial \tau^*} = -\frac{(\phi\phi^*)^{-\sigma}\phi}{1-(\phi\phi^*)^{1-\sigma}}G^*$ so that $\frac{\partial G^*}{\partial \tau^*} - \frac{\partial G^*}{\partial \tau} \frac{\partial \tau}{\partial G} \frac{\partial G}{\partial \tau^*} = \frac{G^*}{\phi^*}$. Hence, there exist Pareto improving tariff changes $(d\tau, d\tau^*)$ for all (τ, τ^*) . These $(d\tau, d\tau^*)$ 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 (τ, τ^*) 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 (τ, τ^*) there exists another (τ, τ^*) which makes one country better off without making the other country worse off. Therefore, they are also indeed Pareto efficient ■

5.3.3 Proof of proposition 3

Proof. By definition, $TB_M = \mu p^{1-\sigma} (n\phi^{*1-\sigma}L^*G^{*\sigma-1} - n^*\phi^{1-\sigma}LG^{\sigma-1})$ so that $\frac{TB_M}{\mu} = \frac{n\phi^{*1-\sigma}L^*}{n\phi^{*1-\sigma}+n^*} - \frac{n^*\phi^{1-\sigma}L}{n+n^*\phi^{1-\sigma}}$. Also, $\frac{nqp}{\mu} = \frac{nL}{n+n^*\phi^{1-\sigma}} + \frac{n\phi^{*1-\sigma}L^*}{n\phi^{*1-\sigma}+n^*}$ from Home's manufacturing market clearing condition. Hence, $n = \frac{\mu L}{qp} + \frac{TB_M}{qp}$ which implies that $dn = 0$ if and only if $dTB_M = 0$. Finally, since $n + n^* = \frac{\mu(L+L^*)}{qp}$, $dn^* = 0$ if and only if $dn = 0$ ■

5.3.4 Proof of proposition 4

Proof. Recall that $G = p [n + n^*\phi^{1-\sigma}]^{\frac{1}{1-\sigma}}$ and $G^* = p [n\phi^{*1-\sigma} + n^*]^{\frac{1}{1-\sigma}}$ 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 ■

5.3.5 Proof of proposition 5

Proof. Recall that $G = p [n + n^*\phi^{1-\sigma}]$ 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 ■

5.3.6 Proof of proposition 6

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

5.3.7 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, $dG = \frac{\partial G}{\partial \tau_1} d\tau_1 + \frac{\partial G}{\partial \tau_1^*} d\tau_1^*$, $dG_1^* = \frac{\partial G_1^*}{\partial \tau_1} d\tau_1 + \frac{\partial G_1^*}{\partial \tau_1^*} d\tau_1^*$, and $dG_2^* = \frac{\partial G_2^*}{\partial \tau_1} d\tau_1 + \frac{\partial G_2^*}{\partial \tau_1^*} d\tau_1^*$. Therefore, $dG = 0$ if $d\tau_1 = -\frac{\partial \tau_1}{\partial G} \frac{\partial G}{\partial \tau_1^*} d\tau_1^*$ and $dG_2^* = 0$ if $d\tau_1 = -\frac{\partial \tau_1}{\partial G_2^*} \frac{\partial G_2^*}{\partial \tau_1^*} d\tau_1^*$. Notice that these two conditions are identical. This is because $\frac{\partial G}{\partial \tau_1} = -\frac{(\phi_1 \phi_1^*)^{-\sigma} \phi_1^*}{\Omega} G$, $\frac{\partial G}{\partial \tau_1^*} = \frac{\Phi_1 \phi_1^{*-\sigma}}{\Omega \Phi} G$, $\frac{\partial G_2^*}{\partial \tau_1} = \frac{\Phi(\phi_1 \phi_1^*)^{-\sigma} \phi_1^* \phi_2^{1-\sigma}}{\Omega \Phi_2} G_2^*$, and $\frac{\partial G_2^*}{\partial \tau_1^*} = -\frac{\Phi_1 \phi_1^{*-\sigma} \phi_2^{1-\sigma}}{\Omega \Phi_2} G_2^*$ so that $-\frac{\partial \tau_1}{\partial G} \frac{\partial G}{\partial \tau_1^*} = -\frac{\partial \tau_1}{\partial G_2^*} \frac{\partial G_2^*}{\partial \tau_1^*}$. Hence, along $dG = dG_2^* = 0$, $dG_1^* = \left(\frac{\partial G_1^*}{\partial \tau_1^*} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial \tau_1}{\partial G} \frac{\partial G}{\partial \tau_1^*} \right) d\tau_1^*$. Notice that $\frac{\partial G_1^*}{\partial \tau_1^*} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial \tau_1}{\partial G} \frac{\partial G}{\partial \tau_1^*} > 0$ for all $(\tau_1, \tau_2, \tau_1^*, \tau_2^*)$. This is because $\frac{\partial G_1^*}{\partial \tau_1^*} = -\frac{(\phi_1 \phi_1^*)^{-\sigma} \phi_1}{\Omega} G_1^*$ which, together with the derivatives given above, implies that $\frac{\partial G_1^*}{\partial \tau_1^*} - \frac{\partial G_1^*}{\partial \tau_1} \frac{\partial \tau_1}{\partial G} \frac{\partial G}{\partial \tau_1^*} = \frac{G_1^*}{\phi_1^*}$. 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 effi-

cient. 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 ■

5.3.8 Proof of proposition 8

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

Moreover, if $d\tau_j = d\tau_j^* = dn_i = 0$, $\frac{dn_j^*}{d\tau_i} = \frac{(\sigma-1)\phi_i^{-\sigma} L \phi_j^{1-\sigma} n_i^*}{G^{2(1-\sigma)} \left[\frac{L_j^* (1-\phi_j^{*1-\sigma})}{G_j^{*2(1-\sigma)}} - \frac{L \phi_j^{1-\sigma} (1-\phi_j^{1-\sigma})}{G^{2(1-\sigma)}} \right]}$ from

Foreign j's manufacturing market clearing condition. Also, $\frac{L_j^* (1-\phi_j^{*1-\sigma})}{G_j^{*2(1-\sigma)}} > \frac{L \phi_j^{1-\sigma} (1-\phi_j^{1-\sigma})}{G^{2(1-\sigma)}}$

for all possible $(\tau_1, \tau_2, \tau_1^*, \tau_2^*, \bar{\tau})$ if and only if $\theta > \left(\frac{L}{L + L_j^*} \right)^{\frac{1}{1-\sigma}}$ which is true because $\theta > \left(\frac{L}{L + 2L_j^*} \right)^{\frac{1}{1-\sigma}}$ by assumption (c.f. appendix A2) ■

5.3.9 Proof of proposition 9

Proof. Recall that $G = p [n + n_1^* \phi_1^{1-\sigma} + n_2^* \phi_2^{1-\sigma}]^{\frac{1}{1-\sigma}}$, $G_1^* = p [n \phi_1^{*1-\sigma} + n_1^*]^{\frac{1}{1-\sigma}}$, and $G_2^* = p [n \phi_2^{*1-\sigma} + n_2^*]^{\frac{1}{1-\sigma}}$ 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

■

5.3.10 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 ■

5.3.11 Proof of proposition 11

Proof. Recall that $G = p [n + n_1^* \phi_1^{1-\sigma} + n_2^* \phi_2^{1-\sigma}]$ 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 ■