Equity-Efficiency Tradeoffs in International Bargaining

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Abstract

This paper analyzes the outcome of international negotiations between asymmetric countries. A main result is that there is a equity-efficiency tradeoff to reducing the flexibility of negotiations in making efficient transfers across countries. Specifically, an increase in the inefficiency of transfers will reduce aggregate global welfare but, when the degree of asymmetry is sufficiently small, can result in a more equitable agreement that benefits the country that is at a bargaining disadvantage. As an application, we show that preventing side-payments in trade negotiations between a large and small country can benefit the small country at the expense of the large country.

1 Introduction

A key element of World Trade Organization (WTO) negotiations since the Uruguay round is the single undertaking in which every item of negotiation is part of a single and indivisible package that must be agreed to by all members. As a result, the process of determining the negotiating agenda has become one of the more contentious parts of international trade negotiations. For example, the Singapore ministerial meeting was notable for the efforts of developing countries (led by India) to exclude investment, competition and labor issues from the Doha agenda, and it is widely acknowledged that such disagreements over the negotiating agenda have been the main driver behind delays in concluding the Doha round (see Rolland (2010)). However, why is establishing the negotiating agenda so contentious? If you think of international trade negotiations as a bargaining game between countries, than changes in the negotiating agenda obviously can affect the utility possibilities set (or bargaining set) of the game. In this paper, we argue that expanding the negotiating agenda to include additional issues or policies can allow for more flexiblity in making transfers across countries and thus make the frontier of the utility possibilities set "less concave". We then show that this greater efficiency can have equity implications and can actually make the country that is at

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a disadvantage in the bargaining game worse-off. This tendency for changes in the efficiency frontier of the bargaining set to have strong equity implications might provide an explanation for why disagreements over the negotiating agenda are so often problemmatic.

To investigate this issue we use a model in which asymmetric countries engage in Nash bargaining, and the disagreement point (the Nash equilibrium) differs from the social optimum (the point that maximizes the joint welfare of the two countries). This reflects the fact that many issues of international negotiation have the structure of a prisoner's dilemma where the non-cooperative equilibrium is not Pareto efficient (e.g., the setting of environmental policy given transboundary pollution or the setting of trade policy given market power). Indeed, this common structure explains the ubiquity of international agreements as there are (potentially) mutually beneficial gains from negotiation in moving towards a more cooperative outcome. However, it is also well known that asymmetries in the gains from cooperation will influence the outcome of negotiations and may even interfere with successful cooperation. In this case, we argue that the shape of the bargaining frontier arises from the efficiency of utility transfers (the efficiency with which countries can adjust the policy mix to transfer utility to the country with the bargaining advantage) which in turn arises from the negotiating agenda: the set of issues and/or policies which are subject to negotiation. In the case of *efficient* utility transfers, international negotiations are sufficiently flexible that the policy mix can be adjusted to transfer utility without reducing aggregate (joint) welfare and the bargaining frontier is linear. However, when countries are more constrained in their ability to negotiate (e.g., the negotiating agenda is limited making transfer payments across countries more difficult) than the bargaining frontier becomes "more concave" as making utility transfers induces more deadweight loss. We show that this inefficiency in the ability to transfer utility (which can arise from the set of policies countries have to negotiate over) has important implications for the outcomes of international bargaining.[1]

First, we show that there is an efficiency-equity tradeoff to allowing more efficient transfers. It should be immediately apparent that a reduction in the efficiency of transfer payments reduces the total efficiency of the agreement (i.e., the bargaining solution results in lower joint welfare for the member countries). However, we show that, when the degree of asymmetry across countries is sufficiently small, a reduction in transfer efficiency can actually increase the equity of the agreement by increasing the welfare of the more disadvantaged country. Intuitively, a reduction in transfer efficiency reduces the amount of the transfer that occurs in equilibrium and thus can potentially

[1]The axiomatic bargaining literature has typically focused on how changes in disagreement payoffs effect the bargaining outcome (e.g., see Thomson (1987)). In contrast, our analysis focuses more on comparative statics with respect to variations in the utility possibilities set. Thus, it is more similar to Anbarci, Skaperdas, and Syropoulos (2002) which compares different bargaining outcomes when players can make a costly investment to improve their disagreement point at the expense of shrinking the utility possibility set.

benefit the country that pays the transfer in the negotiated equilibrium. Such equity concerns might explain the puzzling fact that explicit side payments are rarely observed in international negotiations. For example, Hardstad (2007) points out that, despite their efficiency as a means of facilitating negotiations, side payments, side agreements and other means of transferring utility are rarely utilized in federal tax unions or international trade and environmental agreements.[2] Our results suggest that attempts to improve the flexibility of negotiations in providing transfers (e.g., through monetary side payments or linking issues) can make the disadvantaged country in the negotiations worse off (and thus, at least one country will have an incentive to protest the increased flexibility).

Second, we derive the implications of country asymmetry on the bargaining equilibrium under the assumption of both efficient and inefficient transfers. We show that, in general, bargaining asymmetry has very little effect on the bargaining solution in the presence of efficient transfers. Indeed, the presence of an efficient transfer system results in a gain to cooperation for any particular country (and thus, the incentive to participate and abide by the terms of the agreement) being independent of the degree of asymmetry across countries involved in the agreement. In contrast, bargaining asymmetry has a much greater impact on the negotiated equilibrium within less flexible agreements where transfers are inefficient. First, we show that, when transfers are inefficient, the country with the bargaining advantage (defined as the country that loses relatively less in reversion to the disagreement point) always loses from an increase in bargaining asymmetry. Since these are precisely the countries for which participation and enforcement constraints are likely to bind, this result suggests that inefficiency in transfers can be problematic for the stability of agreements across asymmetric countries. In contrast, we derive a case where the "disadvantaged" country gains from an increase in bargaining asymmetry (similar to our previous result, this is more likely to occur when the degree of asymmetry is sufficiently small). Thus we derive that inefficiency in transfers tends to favor the disadvantaged country and thus may result in a more equitable agreement (at the expense, perhaps, of agreement stability).

As an application of these general results, we consider the question of monetary side payments within an international trade agreement between asymmetric countries. This issue has both theoretical and practical relevance. On the theoretical side, the recent literature on trade agreements rarely considers the implications of bargaining theory for understanding the outcomes of trade negotiations.[3] The majority of papers assume symmetry across countries which makes bargaining

[2]Hardstad (2007) provides an alternative explanation of this puzzle by showing that, in a situation of asymmetric information, efficient side payments can reduce the efficiency of the agreement since they might encourage costly signaling. In contrast, we assume perfect information and *inefficient* side payments and derive a more equity-based concern.

[3]Indeed, the few exceptions are typically some of the original papers in the literature such as Riezman (1982), Harrison and Rutström (1991) and Furusawa (1999).

somewhat moot and implies a focus on the globally optimal outcome (typically, free trade) as the bargaining solution. However, international agreements often involve asymmetric countries and, as far back as Riezman (1982), it was known that the globally optimal solution (free trade) would often not emerge as the outcome of a bargaining game between asymmetric countries. This introduces a complexity into modeling international trade agreements among asymmetric countries that the literature handles in several ways. The first method is to not focus on any explicit bargaining outcome but rather focus simply on the efficiency frontier (or Pareto efficiency) as the goal of an international agreement (examples of this approach include Bagwell and Staiger (1999), Ludema (1991), Mayer (1981) and Bond and Park (2002)). A second approach is to focus on the globally optimal outcome as either a focal point to which an agreement might strive (see Dixit (1987), Ederington (2001) and Limao and Saggi (2013)) or as the outcome of a bargaining game given the existence of efficient utility transfers (e.g., see Park (2000) and Grossman and Helpman (1995)). In contrast, our paper looks at the bargaining outcome of negotiations between asymmetric countries in the absence of efficient utility transfers.[4].

On the practical side, allowing more scope and flexibility for side payments is often suggested as a natural means of dealing with country asymmetry in international negotiations. For example, the trade literature shows that global free trade will often fail to emerge as the outcome of negotiations between asymmetric countries (see Riezman (1982) and Kennan and Riezman (1988)) and that, in such cases, side payments are necessary to make the trade agreement globally efficient (see Kowalczyk and Sjöström (1994), Kowalczyk (2000) and Park (2000)). Indeed, several recent papers have argued for greater use of financial instruments within trade agreements (e.g., see Limao and Saggi (2013) and Kowalczyk and Sjöström (2009)). We show that, from a bargaining prospective, such side payments might result in equity concerns as, when the degree of asymmetry is sufficiently small, they can make the more disadvantaged country (which, in our model, is the smaller, poorer country) worse off. Thus, our results provide a possible equity-related rationale for why there is no tradition of, or mechanism for, income transfers (or other non-trade related concessions) within the General Agreement on Trade and Tariffs (GATT) negotiations.

In what follows, Section 2 presents the basic model of international negotiations and derives how changes in country asymmetry and the efficiency of transfers affects the bargaining solution. Section 3 considers a particular case of international trade negotiations between a large and small country, and derives the conditions under which the small country would be better off when trade negotiations forbid the use of side payments. Finally, Section 4 concludes.

[4]Note that even when countries have access to (and utilize) monetary transfers, the assumption of efficient utility transfers can be problematic (see Bergstrom and Varian (1985))

2 Model

Consider a two-country bargaining problem where countries x and y negotiate over a set of policy instruments (let τ_x and τ_y represent policy levels, respectively, for each country). Country preferences over outcomes are given by the utility function $w_x(\tau_x, \tau_y)$ and $w_y(\tau_x, \tau_y)$ respectively. As in Nash (1950), we assume that the set of possible agreements $W = (w_x, w_y)$ is convex and compact. The disagreement point $d \in W$ is assumed to be the Nash equilibrium:

$$d_x \equiv w_x(\tau_x^N, \tau_y^N) \; and \; d_y \equiv w_y(\tau_x^N, \tau_y^N) \tag{1}$$

where

$$\tau_x^N \equiv \underset{\tau_x}{\operatorname{argmax}}\, w_x(\tau_x, \tau_y) \; and \; \tau_y^N \equiv \underset{\tau_y}{\operatorname{argmax}}\, w_y(\tau_x, \tau_y) \tag{2}$$

In what follows, we refer to the *bargaining set* (denoted W^P) as the set of possible bargaining outcomes that both individuals prefer to the disagreement point (i.e., $W^P = \{w \in W : w_x \geq d_x, w_y \geq d_y\}$). Importantly, we assume the existence of some distortion (e.g., transboundary pollution in an environmental agreement or terms-of-trade concerns in a trade agreement) such that there exists a "globally optimal outcome" ($w^* \in W$) which maximizes aggregate welfare and, thus, results in greater joint welfare than the Nash equilibrium:

$$w_x^* \equiv w_x(\tau_x^*, \tau_y^*) \; and \; w_x^* \equiv w_x(\tau_x^*, \tau_y^*) \tag{3}$$

where

$$\tau_x^* \equiv \underset{\tau_x}{\operatorname{argmax}}\, w_x(\tau_x, \tau_y) + w_y(\tau_x, \tau_y) \; and \; \tau_y^* \equiv \underset{\tau_y}{\operatorname{argmax}}\, w_x(\tau_x, \tau_y) + w_y(\tau_x, \tau_y) \tag{4}$$

and

$$w_x^* + w_y^* > d_x + d_y \tag{5}$$

Note that this assumption implies that we are restricting our attention to positive-sum games (which is the typical case in international agreements). The aggregate-welfare maximizing outcome (w^*) we refer to as the *social optimum*. The position of the social optimum relative to the Nash equilibrium in the payoff space gives an indication of the degree of asymmetry in the bargaining game. Indeed, for player $i \neq j$ in $\{X, Y\}$, define the degree of asymmetry by:

$$\rho_i = \frac{w_i^* - d_i}{w_j^* - d_j}$$

We say player i has a bargaining disadvantage relative to j if $\rho_i > 1$. Thus, if the social optimum lies along the 45 degree line from the origin (i.e., Nash), $\rho_i = 1$ and both countries gain equally in

moving from the Nash to the social optimum (i.e., the symmetric case). In contrast, if the social optimum lies below the 45 degree line, it implies an asymmetry in that the country on the horizontal axis loses relatively more in reverting from the social optimum to the disagreement point (i.e., is at a "bargaining disadvantage"). Indeed, later in the paper we provide a concrete example of this possibility in the case of trade negotiations between a large and small countries. Other situations where this might occur include environmental negotiations over transboundary pollution where the disutility to such pollution is asymmetric across countries (e.g., between upstream and downstream countries). In addition, note that we do not restrict ourselves to the case that the social optimum is necessarily preferred by both parties to the disagreement point (i.e., it is possible that w^* lies outside the boundary of the bargaining set). Such a situation can occur in cases of extreme asymmetry such as when transboundary pollution is entirely one-way or, as in Kennan and Riezman (1990), where large countries can actually "win"' a trade war (relative to free trade).

Following Nash (1950) and Luce and Rafia (1957) we define the *efficiency frontier* as the set of payoff vectors not dominated, even weakly, by other payoff vectors in W(i.e., the upper-right boundary of W) and denote it by W^B (this is also referred to as the negotiation set). It is direct to show that the social optimum is a point on the efficiency frontier (i.e., $w^* \in W^B$). Note that other points on the efficiency frontier (i.e., moving away from the social optimum) involve some type of utility transfer between the two countries. It should be apparent that we are defining transfers quite generally in this paper, as any change in the negotiated policy set that results in a transfer of utility (the set of policy instruments over which the countries bargain could include direct monetary payments, but this is not necessary). If efficient utility transfers are available, then countries can adjust the policy mix to transfer utility without reducing aggregate utility (i.e., the efficiency frontier is linear line going through w^* with a slope of -1).[5] In contrast, we refer to *inefficient transfers* as negotiated concessions on policy to exchange utility that reduces aggregate welfare (i.e., moving away from the social optimum entails some distortionary cost).

The argument in this paper is that decisions about the negotiation agenda (i.e., the set of policies and instruments subject to negotiation) can affect the efficiency of transfers and thus the shape of the efficiency frontier. In Section 3 we provide a specific example in which we compare bargaining outcomes when the negotiating agenda just involves trade policy (and thus any transfers are entirely through trade concessions) to where the agenda includes monetary transfers as well. However, the broader application is to investigate how an expansion of the negotiating agenda, which allows countries more flexibility in making transfers, might make the efficiency frontier more linear and

[5]This is a strong assumption as efficient transfers refers to the ability to make linear utility transfers and not simply lump-sum monetary transfers. However, many models of international negotiation between asymmetric countries assume both quasi-linear utility and the existence of lump-sum cash transfers, the combination of which would make efficient utility transfers possible.

thus effect the bargaining outcome.

The key question addressed in this paper concerns the solution to the bargaining game when countries are asymmetric. We use the well-known Nash Bargaining Solution (NBS) proposed by Nash (1950). The Nash solution is the one typically chosen when analyzing international negotiations (for examples of this see Riezman (1982) and Furusawa (1999)), and there are numerous non-cooperative bargaining games whose solutions approximate the NBS (e.g., see Binmore, Osborne, and Rubenstein (1986)).[6] Thus, in what follows, we consider how changes in country asymmetry in the bargaining process (as well as the efficiency of transfers) affects the NBS.

First, without loss of generality, assume the following:

Assumption A1: Assume $\rho_x > 1$

Under this assumption country x faces a bargaining disadvantage, and the bargaining solution will requires x to make some type of transfer to y (i.e., the NBS entails a movement along the efficiency frontier away from the social optimum in favor of country y). Second, to allow for an analytical solution, assume that any distortionary cost of a transfer is linear. That is, assume that the efficiency frontier (for the area above the socially optimal point) is given by a linear line defined by the following equations:

$$w_y = w_y^* + \alpha T$$

and

$$w_x = w_x^* - T,$$

where $0 \leq \alpha \leq 1$ and T represents the magnitude of the utility transfer from x to y. Note that α represents the distortionary cost of moving away from the social optimum (i.e., the distortionary cost of any transfers). This set-up is reflected in Figure 1 where the position of the the Nash equilibrium and the social optimum (labeled C) reflects that country x faces a bargaining disadvantage. To simplify notation, let $W^e = w_y^* + \alpha w_x^*$, and thus the equation of line AC (the efficiency frontier above the social optimum) is given by:

$$w_y + \alpha w_x = W^e \tag{6}$$

Similar calculations define the efficiency frontier below the social optimum (line CD in Figure 1). Thus the assumption of inefficient transfers implies a bargaining set defined by a kinked efficiency frontier originating from the socially optimal point (denoted by the shaded area in Figure 1). The

[6]Harrison and Rutström (1991) utilize a numerical general equilibrium model and find that the bilateral trade negotiations between the U.S. and Canada in 1989 were consistent with a Nash bargaining solution (with Nash tariffs as the disagreement point).

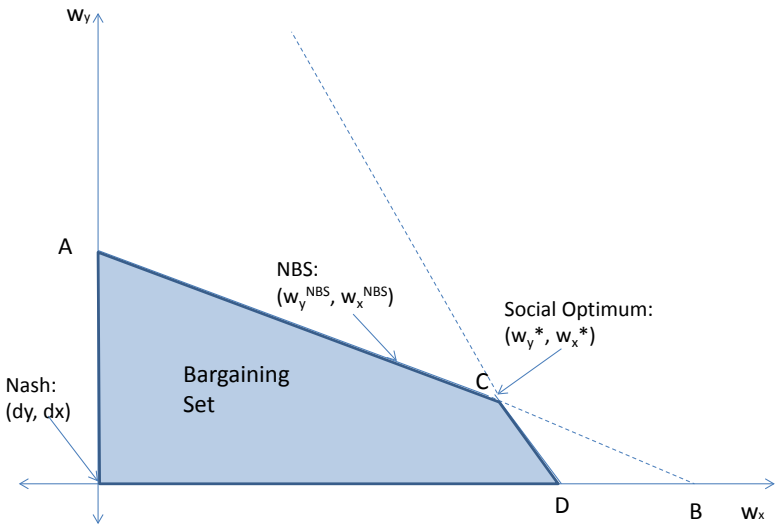

Figure 1: Characterization of the bargaining problem, $\alpha < 1$

shape of the bargaining set simply reflects our assumption that there exists some distortionary cost to moving away from globally optimal policies.

As is well known, the geometry of the Nash (1950) solution is that the NBS is the midpoint of a tangency to the efficiency frontier of the bargaining game (which, in this case, is line AB). However, given our assumption of a linear distortionary cost, we must be concerned about the potential for a corner solution where such a midpoint lies outside the efficiency frontier (in which case it is direct to show that the NBS is simply equal to the socially optimal outcome). Intuitively, this corner solution occurs when the distortionary cost of the transfer is "so large" that no transfer is used in the bargaining equilibrium. As we derive below, the condition for a corner solution is simply that the distortionary cost of the transfer is greater than the degree of asymmetry in the bargaining game:

LEMMA 1 *If*

$$\rho_y = \frac{w_y^* - d_y}{w_x^* - d_x} > \alpha \tag{7}$$

then the Nash Bargaining Solution (NBS) is a corner solution where welfare levels for country x and country y are given by:

$$(w_x^{NBS}, w_y^{NBS}) = (w_x^*, w_y^*)$$

.

Proof: For a fixed $0 < \alpha < 1$, the condition for a corner solution for the NBS point is that the midpoint of the tangency to the efficiency frontier lies outside the bargaining set:

$$w_x^{NBS} > w_x^*.$$

where w_x^{NBS} is the midpoint to the tangency. Substitution using (8) gives

$$\frac{1}{2\alpha}W^e - \frac{1}{2\alpha}d_y + \frac{1}{2}d_x > w_x^*,$$

or

$$\frac{1}{2\alpha}[w_y^* + \alpha w_x^*] - \frac{1}{2\alpha}d_y + \frac{1}{2}d_x > w_x^*,$$

which can be rewritten as (7). Q.E.D.

However, if we assume that the distortionary cost is sufficiently small (or the degree of asymmetry is sufficiently large) then the typical geometry of Nash (1950) applies and the NBS is the midpoint of the line segment $\overline{AB}$. Thus, we can derive our second lemma:

LEMMA 2 *If $\alpha > \rho_y$, welfare levels in the Nash Bargaining Solution (NBS) for country x and y are given by:*

$$(w_x^{NBS}, w_y^{NBS}) = (\frac{1}{2\alpha}W^e - \frac{1}{2\alpha}d_y + \frac{1}{2}d_x, \frac{1}{2}W^e + \frac{1}{2}d_y - \frac{\alpha}{2}d_x) \tag{8}$$

Proof: Let the coordinates of point $i \in A, B$ be given by (w_x^i, w_y^i). From Figure 1, we have that $w_x^A = d_x$. Using equation (6), we get

$$w_y^A = W^e - \alpha d_x.$$

Similarly, $W_y^B = d_y$ and (using 6)

$$W_x^B = \frac{1}{\alpha}[W^e - d_y].$$

The NBS (denoted by point NBS in Figure 1) is the midpoint of the line segment $\overline{AB}$:

$$(w_x^{NBS}, w_y^{NBS}) = (\frac{w_x^A + w_x^B}{2}, \frac{w_y^A + w_y^B}{2}).$$

Substitution produces (8). Q.E.D.

To understand how the inefficiency of transfers affects bargaining, it is instructive to calculate each country's share of the total gains from bargaining. That is, we calculate the share for player i of the total gain in moving from the disagreement point (Nash equilibrium) to the negotiated agreement (Nash bargaining solution):

$$STG_i = \frac{w_i^{NBS} - d_i}{(w_x^{NBS} + w_y^{NBS}) - (d_x + d_y)}$$

Substituting in from (8) it is direct to derive that:

$$STG_x = \frac{1}{\alpha+1} \; and \; STG_y = \frac{\alpha}{\alpha+1} \tag{9}$$

Thus, given some degree of asymmetry (such that utility transfers are needed) a country's share of the total gains from bargaining is determined entirely by the degree of inefficiency of the transfer (at least for our linear cost case). The intuition behind this result is direct. As is well known, the symmetry of the NBS pushes countries to share equally in the gains to any negotiation. Thus, in the case of bargaining asymmetry, the country that would gain more from the agreement (e.g., a small country signing a free trade agreement with a large country) will compensate the other country in the negotiated agreement (i.e., utility transfers). As can be seen, when utility transfers are efficient (i.e., when $\alpha = 1$), the two countries share the gains symmetrically (i.e., $STG_i = 1/2$). However, when utility transfers are inefficient ($\alpha < 1$), the two countries do not share the gains equally ($STGB_i \neq 1/2$) with the disadvantaged country capturing a greater share of the gains ($STGB_x > 1/2$). In the sections that follow, we explore how this tradeoff between efficiency and equity impacts the NBS as we change the degree of efficiency and symmetry in the bargaining game.

2.1 International bargaining and the efficiency of transfers

The above proposition suggests that disadvantaged countries disproportionally benefit in the NBS in the presence of inefficient transfers. However, this raises a question: would a disadvantaged country actually prefer more distortionary transfers? In the context of our model, this question hinges on whether welfare of the disadvantaged country increases in the NBS as α is decreased. As we show in the following proposition, this is the case provided the degree of asymmetry is sufficiently small.

PROPOSITION 1 *If $\alpha > \rho_y$, we find that:*

- *when the degree of asymmetry is sufficiently small such that both countries gain in moving from the disagreement point to the social optimum, then the welfare of the disadvantaged country increases in the NBS as the distortionary cost of the transfer increases.*
- *when the degree of asymmetry is sufficiently large such that a country loses on moving from the disagreement point to the social optimum, then the welfare of the disadvantaged country decreases in the NBS as the distortionary cost of the transfer increases.*

Proof: Lemma 2 and the definition of W^e imply

$$w_x^{NBS}(\alpha) = \frac{1}{2\alpha}[w_y^* + \alpha w_x^*] - \frac{1}{2\alpha}d_y + \frac{1}{2}d_x$$

Therefore,

$$\frac{dw_x^{NBS}}{d\alpha} = \frac{d_y - w_y^*}{4\alpha^2}$$

It is direct to derive that this expression is positive if $d_y - w_y^* > 0$ (i.e., $\rho_y < 0$ and the advantaged country loses in moving to the social optimum) and negative if $d_y - w_y^* < 0$ (i.e., $\rho_y > 0$ and the advantaged country gains in moving to the social optimum). Q.E.D.

The intuition behind this result relies on two opposing forces. First, the distortionary cost results in fewer transfers being utilized (i.e., the NBS is pulled towards the social optimum) which benefits the disadvantaged country which disproportionately benefits from socially optimal policies. Second, the distortionary cost of the transfers results in less aggregate utility which hurts the disadvantaged country (which suffers its share of this welfare cost). Basically, the above proposition shows that when the degree of asymmetry is small, the first mechanism is dominant and the disadvantaged country gains from increased inefficiency. However, when the degree of asymmetry is sufficiently large, the transfers become larger and the second mechanism dominates resulting in the disadvantaged country losing from inefficiency. Thus, our results suggest a nonlinearity in the way in which inefficiency in bargaining transfers affects the welfare of disadvantaged countries in international negotiations.

However, note that most instances of international negotiations are mutually beneficial in that both countries gain in moving to the globally optimal equilibrium (i.e., the case where $\rho_y < 0$ is an extreme case that rarely occurs). Thus, Proposition 1 suggests that, in general, the disadvantaged countries will benefit as transfers become less efficient. We would argue that this provides a possible explanation for strong disagreements over the negotiating agenda as advantaged countries will push to expand the agenda to make utility transfers easier, while disadvantage countries attempt to restrict the agenda as a means of constraining bargaining flexibility.

2.2 International bargaining and asymmetry in the disagreement point

As we have shown in the above propositions, inefficient transfers disproportionally benefit disadvantaged countries in the NBS to the extent that, in certain situations, such countries might actually prefer restricting the efficiency of transfers. However, this raises a second question: how do changes in the asymmetry of the underlying bargaining game (i.e., ρ_x) affect the outcomes of international negotiations? Note that ρ_x is a function of two things: the position of the socially optimal point (w^*) and the position of the disagreement point (d). Thus, in the calculations that follow, we move each of these points in turn (so as to increase ρ) while holding total (potential) aggregate welfare constant. In this section, we consider changes in the disagreement point.

First, holding the social optimum constant, imagine generating additional asymmetry (i.e., increasing ρ_x) by moving the disagreement point (d^*) up and to the left along a line with slope -1 (in this case we are holding the sum of utility in the Nash equilibrium constant but implying that the country on the x-axis loses relatively more in moving from the social optimum to the N.E.). Before discussing the case of inefficient transfers, it is instructive to consider the case of efficient transfers

(i.e., when $\alpha = 1$):

PROPOSITION 2 *Holding the social optimum constant (i.e., $\Delta w_x^* = \Delta w_y^* = 0$) consider an equivalent and offsetting change in the disagreement point (i.e., $\Delta d_x = -\Delta d_y$) such that the degree of asymmetry in the bargaining game (ρ_x) increases. In the presence of efficient transfers (i.e., $\alpha = 1$):*

- *Welfare in the Nash Bargaining Solution (NBS) adjusts equivalently (i.e., $\Delta w_i^{NBS} = \Delta d_i$).*
- *The welfare gain to the agreement (i.e., $w_i^* - d_i$) is independent of such a shift in bargaining position.*

Proof: First, note that when $\alpha = 1$ the condition for an interior solution (i.e., $\alpha > \rho_y$) is automatically satisfied. Thus, it is direct to see from (8) that, holding α constant:

$$\Delta w_x^{NBS} = \frac{1}{2\alpha}\Delta W^e - \frac{1}{2\alpha}\Delta d_y + \frac{1}{2}\Delta d_x \tag{10}$$

and

$$\Delta w_y^{NBS} = \frac{1}{2\alpha}\Delta W^e + \frac{1}{2}\Delta d_y - \frac{\alpha}{2}\Delta d_x \tag{11}$$

Note that our shift in the disagreement point is holding the socially optimal point constant (i.e., $\Delta W_e = 0$). In addition, given that $\alpha = 1$, an equivalent and off-setting shift in the disagreement point such that $\Delta d_x = -\Delta d_y$ implies that $\Delta w_i^{NBS} = \Delta d_i$. Q.E.D.

Proposition 2 is partly a function of the well-recognized result that changes in the position of the disagreement point (and thus the bargaining position) are reflected in change in the NBS. However, the above results also reflect a less well-recognized point that, in the presence of the efficient transfers, the *additional* welfare to be achieved on signing an agreement is independent of any asymmetry in the bargaining position. This result is noteworthy as the "gains to cooperation" are an important theoretical construct which repeatedly appear in both the trade and environmental literature on international agreements. For example, they are central to any analysis of which countries are likely to join an agreement (see, for example, Carraro and Siniscalco (1993)). In addition they are critical in analyzing whether countries are likely to abide by the terms of the agreement (see the literature on self-enforcing trade agreements starting with Dixit (1987), or that on international environmental agreements starting with Barrett (1994)). However, next we consider the effects of the same shift in bargaining position on the NBS in the presence of inefficient transfers:

PROPOSITION 3 *Assume $\alpha > \rho_y$. Holding the socially optimal point constant (i.e., $\Delta w_x^* = \Delta w_y^* = 0$) consider an equivalent and offsetting change in the disagreement point (i.e., $\Delta d_x = -\Delta d_y$) that increases the degree of asymmetry in the bargaining game (i.e., an increase in ρ_x). In the presence of inefficient transfers (i.e., $\alpha < 1$) we find that:*

- *welfare in the NBS falls for the disadvantaged country, but less than proportionally (i.e.,* $\Delta d_x < \Delta w_x^{NBS} < 0$*). Thus, for the disadvantaged country, the gain to signing the agreement increases.*

- *welfare in the NBS rises for the advantaged country, but less than proportionally (i.e.,* $\Delta d_y > \Delta w_y^{NBS} > 0$*). Thus, for the advantaged country, the gain to signing the agreement decreases.*

Proof: Given $\alpha > \rho_y$*, changes in the NBS are given by (10) and (11). As in the proof to Proposition 2, our shift in the disagreement point is holding the socially optimal point constant (i.e.,* $\Delta W^e = 0$*). However, now that* $\alpha < 1$*, an equivalent shift in the socially optimal point such that* $\Delta d_x = -\Delta d_y$ *and* $\Delta d_x < 0$ *implies that* $\Delta d_x < \Delta w_x^{NBS} < 0$ *and* $\Delta d_y > \Delta w_y^{NBS} > 0$*. Q.E.D.*

In a way, the above proposition is a corollary to Proposition 1. Recall that the inefficiency of any transfer system within international negotiations reduces the total amount of transfers between countries within the NBS and thus provides an extra benefit to disadvantaged countries and an extra cost to advantaged countries. What Proposition 3 shows is that this inefficiency effect results in a more "equitable" division within the NBS as the cost of any bargaining asymmetry is, in a sense, shared across countries. Specifically, while with efficient transfers any increase in the asymmetry of the disagreement point is fully reflected in the bargaining outcome (Proposition 2), with inefficient transfers it is only partly reflected. That is, the disadvantaged (advantaged) country becomes worse off (better off) but by less than the full amount of the change. As a result, Proposition 3 shows that disadvantaged countries gain even more from the agreement than before while advantaged countries gain less.

Proposition 3 is relevant for the design and structure of international negotiations with respect to issues of participation and enforcement in international agreements. For obvious reasons, countries that gain less from the agreement are also less likely to participate in the agreement or abide by the terms of the agreement. Note that, from our definition of bargaining asymmetry, it is the "advantaged" countries for whom these participation and enforcement constraints are more likely to bind. However, an implication of Proposition 2 is that, given efficient transfers, any asymmetry across countries does not transfer into asymmetry in either participation and enforcement since the algebra of the NBS is that the gains to cooperation are always equalized across countries regardless of the degree of asymmetry in the bargaining set. Thus, changes in the degree of asymmetry have very little effect on either participation or enforcement of the agreement. Proposition 3 suggests this is no longer the case in the absence of efficient transfers. Specifically, since inefficient transfers result in the advantaged country gaining relatively less in the agreement, it suggests that participation and enforcement constraints will become more problematic as the degree of asymmetry across countries increase (since these constraints were more likely to bind for advantaged countries in the first place). Thus, combining Propositions 2 and 3 suggests that an expansion of the negotiation agenda that

makes cross-country transfers more efficient will be especially important in improving the stability of the agreement when countries are asymmetric.

2.3 International bargaining and the asymmetry of the social optimum

Next, consider holding the disagreement point constant while generating additional asymmetry (i.e., increasing ρ_x) by moving the social optimum (w^*) down and to the right along a line with slope -1 (in this case we are holding the sum of utility constant but implying that the country on the x-axis loses relatively more in moving from the social optimum to the Nash equilibrium). Once again, before discussing the case of inefficient transfers, it is instructive to consider the case of efficient transfers (i.e., when $\alpha = 1$). As we show in the following proposition, such an asymmetric shift will not affect the NBS:

PROPOSITION 4 *Holding the disagreement point constant (i.e., $\Delta d_x = \Delta d_y = 0$) consider an equivalent and offsetting change in the socially optimal point (i.e., $\Delta w_x^* = -\Delta w_y^*$) such that the degree of asymmetry in the bargaining game (ρ_x) increases. In the presence of efficient transfers (i.e., $\alpha = 1$), welfare for both countries in the Nash Bargaining Solution (NBS), and the respective gains to joining the agreement, are independent of such a shift in bargaining position.*
Proof: As before, when $\alpha = 1$ the condition for an interior solution (i.e., $\alpha > \rho_y$) is automatically satisfied and changes in the welfare of the NBS are given by (10) and (11). Note that our shift in the socially optimal point is holding the disagreement point constant (i.e., $\Delta d_x = \Delta d_y = 0$). In addition, given that $\alpha = 1$, an equivalent shift in the socially optimal point such that $\Delta w_x^* = -\Delta w_y^*$ implies that $\Delta W^e = 0$. Q.E.D.

Thus, as long as the disagreement point is held constant, changes in the asymmetry of the bargaining game do not affect the NBS. The intuition behind this is that, with efficient transfers, equivalent shifts in the socially optimal point (that keep aggregate utility constant) do not change the shape of the efficiency frontier. Specifically, the social optimum is always on the efficiency frontier by definition. However, with asymmetry, one country (the advantaged) gains less from moving away from the disagreement point to the social optimum than the other country (the disadvantaged country). Thus, the advantaged country demands compensation (i.e., transfers) in the NBS (which imposes symmetry). With efficient transfers, the advantaged country is perfectly compensated for such asymmetry and thus, holding the disagreement point constant, welfare in the NBS will be independent of the degree of asymmetry in the model. Next, we consider the effects of the same shift in bargaining position on the NBS in the presence of inefficient transfers:

PROPOSITION 5 *Holding the disagreement point constant (i.e., $\Delta d_x = \Delta d_y = 0$) consider an equivalent and offsetting change in the socially optimal point (i.e., $\Delta w_x^* = -\Delta w_y^*$) that increases the*

degree of asymmetry in the bargaining game (i.e., an increase in ρ_x). In the presence of inefficient transfers (i.e., $\alpha < 1$) we find that:

- *welfare in the NBS, and the gain to joining the agreement, rises for the disadvantaged country when the degree of asymmetry is sufficiently small*
- *welfare in the NBS, and the gain to joining the agreement, falls for the disadvantaged country when the degree of asymmetry is sufficiently large*
- *welfare in the NBS, and the gain to joining the agreement, falls for the advantaged country regardless of the degree of asymmetry.*

Proof: When the initial degree of asymmetry is sufficiently small (i.e., $\rho_Y \approx 1$) the condition for an interior solution does not hold ($\rho_y > \alpha$) and we have a corner solution in which $w_i^{NSB} = w_i^*$. Thus, an equivalent change in the socially optimal point such that $\Delta w_x^* > 0$ and $\Delta w_y^* < 0$ implies an increase (decrease) in welfare for the disadvantaged (advantaged) country. However, as the degree of asymmetry continues to increase, ρ_Y continues to decrease and eventually $\rho_y < \alpha$, such that we have an interior solution and changes in the NBS are given by (10) and (11). As in the proof to Proposition 3, our shift in the socially optimal point is holding the disagreement point constant (i.e., $\Delta d_x = \Delta d_y = 0$). However, now that $\alpha < 1$, an equivalent shift in the socially optimal point such that $\Delta w_x^* = -\Delta w_y^*$ implies that $\Delta W^e < 0$, which implies that the welfare of both countries is declining in the NBS. Q.E.D.

As we can see from Proposition 5, welfare in the NBS is no longer independent of the degree of asymmetry in the bargaining game. As before, the advantaged country desires compensation to move from the disagreement point to the efficiency frontier. However, with inefficient transfers, the advantaged country is not completely compensated because of the distortionary cost. Thus, greater asymmetry hurts the advantaged country by pulling the NBS below the 45 degree line. As in Proposition 1, this result is due to the fact that inefficient transfers, while reducing joint welfare within the agreement, have a positive benefit for the disadvantaged country in that they result in fewer transfers being utilized within the NBS (i.e., the NBS is pulled towards the social optimum). Basically, our proposition shows that when the degree of asymmetry is small so that transfers are not too large, this equity mechanism is dominant and the disadvantaged country gains from increased asymmetry.

3 Application: Side payments in Trade Agreements between Asymmetric Countries

As an application of our results, we consider the issue of whether to include monetary side payments in the negotiating agenda of international trade agreements. The standard story of trade agreements relies on cost-shifting concerns: that part of the cost of a tariff is borne by foreign exporters in the form of lower "world" prices, resulting in unilateral tariff choices being higher than is optimal from a global perspective. Thus, the purpose of international trade negotiations is to provide a forum for countries to internalize these terms-of-trade externalities and negotiate reciprocal reductions in their restrictions on trade (see Bagwell and Staiger (1999)). However, often trade negotiations occur between asymmetric countries with large disparities in market power. As the trade literature is quite aware, such country asymmetry can create problems with the efficiency (Riezman (1982)), participation (Kowalczyk and Sjöström (1994)) and enforcement (Limao and Saggi (2013)). Thus, it is perhaps not surprising that all of these papers discuss the increased use of monetary side payments as a means of addressing country asymmetry problems. However, an interesting aspect of actual trade negotiations is that explicit side payments in exchange for the removal of trade barriers are almost never observed and most international trade agreements (including the WTO/GATT) tend to restrict negotiations to concessions over market access.[7] Of course, past negotiations might have involved less direct "side payments" as countries informally exchange other concessions (e.g., political, military, legal) in return for the removal of trade barriers, but there is no long-standing tradition or formal system of exchanging side payments for trade concessions in trade negotiations. Indeed, within the WTO, the combination of the single undertaking approach with the establishment of a formal negotiating agenda restricts the ability of countries to make such side-payments. Thus, in this section we analyze the implications of allowing countries greater flexibility in trade negotiations (e.g., utilizing income transfers) on the efficiency and equity of the bargaining solution.

To provide an illustrative example, we construct a standard general equilibrium model of trade between two asymmetric countries that is often utilized in the trade agreement literature. Each country has the ability to produce three goods: a homogeneous good, $j = 0$, and two differentiated goods, $j = x, y$, all of which are traded. We assume that the countries produce the homogeneous good using identical technologies, but that country x has an absolute advantage in producing (and thus exports) good x and country y has an absolute advantage in producing good y. Countries have access to trade policy (an import tariff on the imported good) and, to generate a motivation for

[7] However, this may be changing. Bilateral agreements such as the North American Free-Trade Agreement have started to include environmental side agreements (which could be seen as exchanging trade concessions for increased protection of the environment) and many negotiations/agreements, including the WTO, are starting to heavily emphasize intellectual property rights.

international bargaining, we assume that both countries are large and thus can shift costs to foreign exporters by imposing restrictions on trade. To generate asymmetry in the bargaining game, we also assume that country x is smaller and thus, as we show, will be at a bargaining disadvantage in international trade negotiations.

3.1 Consumers

Each country i is populated by a measure λ_i of identical consumers. For ease of exposition, we assume that $\lambda_i = 1$ for country x while $\lambda_i = \lambda \geq 1$ for country y (i.e., country y is larger). Preferences are quasi-linear in the homogeneous good and are represented by the utility function:

$$u(c_i) = c_{i0} + [c_{ix} - \frac{c_{ix}^2}{2}] + [c_{iy} - \frac{c_{iy}^2}{2}] \tag{12}$$

where c_{ij} represents consumption of good j by individual consumers in country i. All consumers are endowed with one unit of labor which they supply inelastically.

From the utility maximization problem, assuming that the parameters are such that consumers consume the homogeneous good in equilibrium, it is direct to derive individual demand of each good as functions of prices and income, m:

$$\begin{aligned} c_{ix} &= 1 - p_{ix} \\ c_{iy} &= 1 - p_{iy} \\ c_{i0} &= m_i - (1 - p_{ix})p_{ix} - (1 - p_{iy})p_{iy}. \end{aligned} \tag{13}$$

where p_{ij} represents the price good j in country i and m_i represents individual income in country i. Thus, aggregate demand for good j in a country of size λ_i is given by $C_{ij} = \lambda_i c_{ij}$.

3.2 Producers

3.2.1 Homogeneous good

The homogeneous good technology transforms labor into output one-to-one and is represented by the production function:

$$y_0 = l_0. \tag{14}$$

Notice that under this production function, provided the homogenous good is produced in positive amounts, in equilibrium the economy's wage is equal to the price of the homogeneous good. In what follows we normalize the price of the homogeneous good to 1 and, thus, the equilibrium wage is also equal to 1.

3.2.2 Differentiated goods

The differentiated goods are produced using labor and an industry-specific fixed factor in a Cobb-Douglas technology. For expositional purposes, we assume that the amount of the fixed factor in each industry for country i to be λ_i where once again $\lambda_i = 1$ for country x and $\lambda_i = \lambda \geq 1$ for country y. As discussed, country x is assumed to have an absolute advantage in producing good x and country y an absolute advantage in producing good y. Specifically, the production function for the *export* good in country of type i, is given by:

$$y_{ii} = \lambda_i [B l_{ii}]^{1/2}, \tag{15}$$

where y_{ii} represents production of good i and l_{ii} represents labor demanded for good i in a country of type i. Likewise the production function for the *import* good in country i is given by:

$$y_{ij} = \lambda_i [(l_{ij}]^{1/2} \tag{16}$$

where y_{ij} represents production of good i in a country of type j.

Profit maximization in the numeraire sector sets the wage rate in the economy at one. For the differentiated product sector it is direct to derive labor demanded (l_{ii}), output (y_{ii}) and profits (π_{ii}) for the export sector of country i as a function of price in the export sector (p_{ii}):

$$l_{ii} = \frac{B\lambda_i (p_{ii})^2}{4} \text{ and } y_{ii} = \frac{\lambda_i B p_{ii}}{2} \text{ and } \pi_{ii} = \frac{B\lambda_i (p_{ii})^2}{4} \tag{17}$$

Expressions for the import sector of country i are symmetrically defined as a function import prices (p_{ij}):

$$l_{ij} = \frac{\lambda_i (p_{ij})^2}{4} \text{ and } y_{ij} = \frac{\lambda_i p_{ij}}{2} \text{ and } \pi_{ij} = \frac{\lambda_i (p_{ij})^2}{4}, \tag{18}$$

3.3 Government

We assume each country i sets trade policy (a tariff, τ_i, on the import good) in order to maximize social welfare.[8] Thus, while the price of the export good for each country is simply equal to the world price (i.e., $p_{ii} = p_i^w$), the imposition of trade protection results in a wedge between the domestic and world for the import good of each country:

$$p_{ij} = p_j^w + \tau_i \tag{19}$$

[8] We could introduce some political-economy concerns into the model, but this should not have a significant effect on our results. As noted by Bagwell and Staiger (1999) since there is no direct international externality associated with political economy motivations for trade restrictions, they will not be the subject of international negotiations. In the context of our model, the introduction of political-economy motivations will symmetrically shift both the Nash equilibrium and the social optimum, and thus have little appreciable effect on the bargaining game.

For simplicity assume the government redistributes revenue from tariffs back to the consumers. Thus aggregate consumer income in country i is:

$$M_i = \sum_i m_i = \sum_j \pi_{ij} + \lambda_i + \tau_i[C_{ij} - y_{ij}] \tag{20}$$

From the market-clearing conditions for each good (i.e., $\sum_i C_{ij} = \sum_i y_{ij}$) it is direct to derive world prices as a function of government policies:

$$p_y^w = \frac{(\lambda + 1) - 1.5\lambda\tau_y}{1/2(\lambda + \beta) + (\lambda + 1)}. \tag{21}$$

$$p_x^w = \frac{(\lambda + 1) - 1.5\tau_x}{1/2(\lambda + \beta) + (\lambda + 1)} \tag{22}$$

The above expressions make clear both the need for international cooperation as well as the source of asymmetry in international bargaining. Specifically, note that the imposition of an import tariff by either country x or y reduces the world price of that good. This provides an incentive for each country to impose positive tariffs in equilibrium as part of the cost of the tariff is passed on to the foreign exporter in the form of a lower world price. However, also note that the tariff for country y (the larger country) has a greater effect on world prices than that of country x. This is the source of bargaining asymmetry in the model as the trade policy of country y affects country x relatively more, placing country x at a disadvantage in international bargaining.

Substituting the derived world prices into the previous expressions, we can then derive welfare for each country (which is equal to the aggregate utility of the representative consumers within each country) as a function of trade policy :

$$\begin{aligned} W_i(\tau_i, \tau_j) = \quad & \textstyle\sum_j \pi_{ij} + \lambda_i + \tau_i[C_{ij} - y_{ij}] - C_{ii}p_i i - Cijp_i j \\ & \lambda_i[(c_{ii} - \tfrac{(c_{ii})^2}{2}) + (c_{ij} - \tfrac{(c_{ij})^2}{2})] \end{aligned} \tag{23}$$

3.4 International Negotiation

In the absence of an international agreement, each country sets tariffs to maximize domestic welfare taking the policy choices of its trading partner as given. Taking the derivatives of W_i with respect to τ_i and solving out the first order conditions, the unilaterally optimal trade policy for each country (τ_i^N) is given by:

$$\tau_x^N = \frac{2(\beta - 1)}{9(\lambda^2 - 1) + [(2 + \beta)(2 + \beta + 6\lambda)]} \, and \, \tau_y^N = \frac{2(\beta - 1)\lambda}{(2 + \beta)(2 + \beta + 6\lambda)} \tag{24}$$

Since markets for the two goods are independent and export policies are prohibited, these optimal policy choices are independent of foreign policy. The assumptions made about the functional forms of the model also ensure that the second-order conditions are satisfied and thus (24) represents a

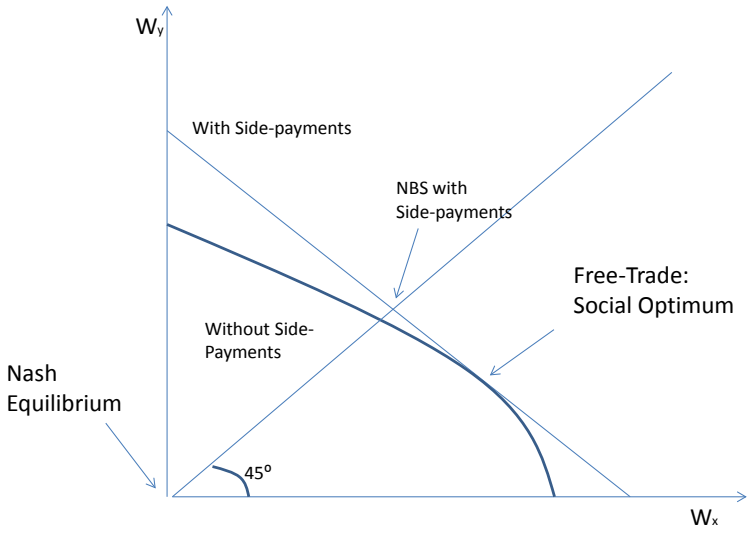

Figure 2: International trade negotiations

unique Nash equilibrium. Note that, when setting policy unilaterally, each country has an incentive to impose tariffs on foreign goods (i.e., $\tau_y > 0$ and $\tau_x > 0$). This is due to standard terms-of-trade considerations in which an import tariff reduces the world price of the good, providing an extra benefit to the importing country (intuitively, each country is passes on part the cost of the tax to foreign exporters). In addition, the asymmetry in market power is reflected in the larger country (y) imposing higher tariffs in the Nash equilibrium (i.e., $\tau_y > \tau_x$).

However, while imposing barriers to trade may be unilaterally optimal, it is obviously not optimal from a worldwide standpoint. Intuitively, from a global standpoint, the terms-of-trade gains/losses will cancel out and the world is left with a suboptimally low level of trade. Indeed it is direct to derive that, not only is free trade ($\tau_x = \tau_y = 0$) the globally optimal policy (in the sense of maximizing $W_x + W_y$), but the *joint* welfare of the two countries is monotonically increasing as either trade barrier is reduced.

Thus, our standard model of trade and trade policy between two countries translates directly into the situation discussed in Section 2 and illustrated in Figure 2. Note that the disagreement point is the Nash equilibrium tariffs defined by (24) while the bargaining set is the set of tariffs $\tau_x \leq \tau_x^N$ and $\tau_y \leq \tau_y^N$ which results in higher joint and unilateral welfare. Finally, the social optimum is the set of free-trade tariffs ($\tau_x = \tau_y = 0$) which maximizes the aggregate-welfare of the two countries. Note also, however, that the asymmetry in country size results in an asymmetry in the bargaining

game. Specifically, country x (the smaller country) gains relatively more in moving from the set of Nash tariffs to free-trade (this is reflected in the social optimum lying below the 45 degree line).

In what follows, we assume countries deal with this terms-of-trade externality by engaging in international negotiations over trade policy whose outcome can be approximated by the Nash Bargaining Solution (NBS). In the event that such international negotiations also include monetary side payments, the NBS is easy to find. Specifically, given side payments (and the assumption of quasi-linear utility which fixes the marginal utility of each country at one), the bargaining frontier is simply a line with slope of one originating from the socially optimal point (i.e., free trade). Thus, the NBS will simply be where this linear bargaining frontier crosses the 45 degree line (labeled "NBS with side payments" in Figure 2). Intuitively, international trade negotiations with side payments will involve free trade (so as to maximize joint welfare) and then a side payment from the small country (x) to the large country (y) due to the bargaining asymmetry involved in the negotiations. Indeed, due to the ease of the analysis, side payments are often assumed when analyzing international trade agreements between asymmetric countries (e.g., see Park (2000) and Grossman and Helpman (1995)).

However, as discussed, conventional trade negotiations rarely involve income transfers and, thus, we solve for the NBS when side payments are not allowed and countries can only exchange trade policy concessions. In this case NBS calculations become more difficult as the bargaining frontier is no longer linear, but is now a concave frontier (once again originating from the socially optimal free-trade point). Intuitively, movements away from global free trade result in deadweight loss that reduces joint welfare and thus "pulls in" the bargaining frontier. Given that the model no longer affords an analytical solution, we rely on numerical simulations to calculate the NBS. Our main point of interest is in comparing the outcomes of negotiations without side payments to those we calculate when side payments are allowed.

In Figure 3 we plot the difference in welfare in the NBS between the agreement without side payments (W_i^{NSP}) and the agreement with side payments (W_i^{SP}) for each country i for different levels of λ (i.e., different degrees of country asymmetry). There are several things to note from Figure 3. First, it should be apparent that disallowing side payments favors the smaller country (x). Indeed, the results of Figure 3 are consistent with Proposition 1 in that, when the degree of asymmetry is relatively small, the disadvantaged (smaller) country gains from preventing the more efficient side payments from occurring (i.e., $W_x^{NSP} - W_x^{SP} > 0$ for λ sufficiently small). As the degree of asymmetry increases, both countries lose from disallowing side payments, although the larger country always loses relatively more (this is true in percentage terms as well). Thus, at least when the degree of country asymmetry is not too large, there might be equity considerations to continuing the practice of not incorporating income transfers and side payments into trade agreements, as doing so favors the smaller (and typically poorer) countries which are at a bargaining disadvantage.

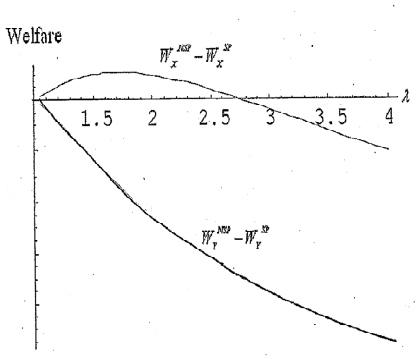

Figure 3: Who Gains from Not Allowing Side Payments?

However, Figure 3 also shows that these equity considerations will come at a cost of efficiency within the agreement. Specifically, adding the two lines in Figure 3 provides the difference in joint welfare between the two types of agreements, and it should be clear that this is negative (i.e., the losses to the large country of disallowing side payments are greater than any gains to the small country) and growing as the degree of asymmetry grows.

4 Conclusion

The main contribution of this paper is to show how changes in the efficiency of utility transfers between countries can affect the shape of the bargaining set and thus the outcome of international negotiations between countries. We show that increasing the efficiency of the transfer system results in the efficiency frontier, becoming flatter which has implications for both the efficiency and equity of the agreement. As a particular application of our results, we investigate the issue of incorporating income transfers into trade negotiations (as has been suggested by several economists) and show that, while such income transfers would increase the efficiency of the negotiated agreement, there might be equity concerns as transfers have the potential to make the smaller countries (who are at a bargaining disadvantage) worse-off. While the most direct application of our model is to the issue of income transfers, it should be apparent that any increase in the flexibility of negotiations that

increases the efficiency of utility transfers (e.g., allowing countries to bargain over a greater range of policy instruments) should have similar results. Thus, our results also seem to apply to the recent movement towards negotiating regional trade agreements that often involve non-trade concessions (i.e., smaller countries agreeing to stricter intellectual property rights or higher environmental and labor standards in exchange for increased market access to developed country markets). While these regional trade agreements rarely involve direct income transfers, the increased bargaining over non-trade concessions can be seen as a form of "transfer" within trade negotiations between asymmetric countries. A concern, shared by both the developing countries themselves as well as some prominent trade economists (e.g., see Bhagwati (2008)) is that developed countries are using their market power in these regional trade agreements to extract "unfair" non-trade related concessions from the smaller countries. Indeed, our results suggest that expanding the scope of bargaining to allow more flexibility in transferring utility to the advantaged (larger) country can result in equity concerns as it has the potential to make the disadvantaged (smaller) country worse off.

Reference

Anbarci, N., Skaperdas, S., and Syropoulos, C. (2002). Comparing bargaining solutions inthe shadow of conflict: how norms against threats can have real effects. *Journal of Economic Theory*, *106*, 1–16.

Bagwell, K. and Staiger, R. (1999). An economic theory of gatt. *American Economic Review*, *89*, 215–248.

Barrett, S. (1994). Self-enforcing international environmental agreements. *Oxford Economic Papers*, *46*, 878–894.

Bergstrom, T. and Varian, H. (1985). When do market games have transferable utility. *Journal of Economic Theory*, *35*, 222–233.

Bhagwati, J. (2008). *Termites in the Trading System: How Preferential Agreements Undermine Free-Trade*. Oxford University Press.

Binmore, K., Osborne, M., and Rubenstein, A. (1986). The nash bargaining solution in economic modeling. *RAND Journal of Economics*, *17*, 176–188.

Bond, E. and Park, J.-H. (2002). Gradualism in trade agreements with asymmetric countries. *The Review of Economic Studies*, *69*, 379–406.

Carraro, C. and Siniscalco, D. (1993). Strategies for the international protection of the environment. *Journal of Public Economics*, *52*, 309–328.

Dixit, A. (1987). Strategic aspects of trade policy. In T.Bewley (Ed.), *Advances in Economic Theory: Fifth World Congress*. Cambridge University Press.

Ederington, J. (2001). International coordination of trade and domestic policies. *American Economic Review*, *91*, 1580–1593.

Furusawa, T. (1999). The negotiation of sustainable tariffs. *Journal of International Economics*, *48*, 321–345.

Grossman, G. and Helpman, E. (1995). Trade wars and trade talks. *Journal of Political Economy*, *103*, 675–708.

Hardstad, B. (2007). Harmonization and side-payments in political cooperation. *AER*, *97*.

Harrison, G. and Rutström, E. (1991). Trade wars, trade negotiations and applied game theory. *The Economic Journal*, *101*, 420–435.

Kennan, J. and Riezman, R. (1990). Optimum tariff equilibria with customs unions. *Canadian Journal of Economics*, *23*, 70–83.

Kennan, J. and Riezman, R. (1988). Do big countries win tariff wars?. *International Economic Review*, *29*, 81–85.

Kowalczyk, C. (2000). Welfare and integration. *International Economic Review*, *41*, 483–494.

Kowalczyk, C. and Sjöström, T. (1994). Bringing gatt into the core. *Economica*, *61*, 301–317.

Kowalczyk, H. K. C. and Sjöström, T. (2009). Global free-trade is the core of a customs union formation game. *Review of International Economics*, *17*, 304–309.

Limao, N. and Saggi, K. (2013). Size inequality, coordination externalities and international trade agreements. *European Economic Review*, *63*, 10–27.

Luce, R. and Rafia, H. (1957). *Games and Decisions: Introduction and Critical Survey*. New York: John Wiley and Son.

Ludema, R. (1991). International trade bargaining and the most-favored nation clause. *Economics and Politics*, *3*, 1–20.

Mayer, W. (1981). Theoretical considerations on negotiated tariff adjustments. *Oxford Economic Papers*, *33*, 135–153.

Nash, J. (1950). The bargaining problem. *Econometrica*, *18*, 155–162.

Park, J.-H. (2000). International trade agreements between countries of asymmetric size. *Journal of International Economics*, *50*, 473–495.

Riezman, R. (1982). Tariff retaliation from a strategic viewpoint. *Southern Journal of Economics*, *48*, 583–593.

Rolland, S. (2010). Redesigning the negotiation process at the wto. *Journal of International Economic Law*, *13*, 65–110.

Thomson, W. (1987). Monotonicity of bargaining solutions with respect to the disagreement point. *Journal of Economic Theory*, *42*, 50–58.