Informational E±ciencies of Multilateral Trade Negotiations

Caglar Özden
Emory University

Abstract

This paper analyzes the e±ciency gains from multilateralism in trade negotiations under asymmetric information. We model the bargaining problem as a mechanism design problem where the optimal mechanism has to satisfy incentive compatibility (IC) and individual rationality (IR) constraints. It is the existence of the (IC) constraints that lead to informational rents and loss of welfare compared to perfect and symmetric information case. In a multilateral bargaining setting composed of independent bilateral relationships, the (IC) and (IR) constraints are the sum of the individual constraints from the bilateral games. Since the marginal social cost of the informational rents are unlikely to be equal in separate bilateral games, by equating these marginal costs in a multilateral setting, we can provide Pareto superior outcomes that were previously unavailable. This decrease in transactions costs due to informational problems is one of the e±ciency enhancing bene®ts of multilateral approach to trade negotiations.

*Department of Economics, Emory University, Atlanta, GA 30322. E-mail: cozden@emory.edu. I would like to thank Anne Krueger for encouragement and guidance, Wedad Elmaghraby, participants at the Stanford Workshop on International Trade and Development for comments and the Olin Foundation for financial support. All errors are mine.
1 Introduction

The benefits and costs of multilateral trade negotiations, as opposed to regional and bilateral ones, have formed the basis of a lively debate among economists (and policymakers) for decades. The success of the rule-based GATT system in liberalizing the world trade in the post-war era was presented as the main evidence in favor of multilateral approaches to trade policy formulation. However the increased number of discriminatory regional arrangements over the last decade and the slowing momentum of the multilateral negotiation rounds led to different interpretations and newer debates. Borrowing Bhagwati’s phrases, some economists view these new regional and/or bilateral treaties as “stepping stones” towards global free trade while others (Bhagwati among them) see them as barriers or “stumbling blocks”.

There had been many papers that manage to show either claim to be true, depending on the assumptions and the models employed.

One of the main arguments against the multilateral efforts (and therefore in favor of bilateral ones) involves the notion that transactions costs become more severe as more countries join these negotiations. With more than hundred countries as members of the GATT and the World Trade Organization (WTO), it has become extremely difficult to continue, let alone conclude, trade negotiation rounds. On the other hand, the claim goes, regional agreements are easier to conduct since they involve fewer countries with similar objectives and characteristics. The increase in the transactions costs of multilateral bargaining is readily accepted even by its ardent supporters who point out other benefits to balance these costs. The delay in reaching an agreement is only one of the transactions costs that appear in bargaining environments and the eight years that took to conclude the Uruguay Round is often cited as a prime example.

The aim of this paper is to challenge the generality of this notion and claim that multilateral negotiations can actually provide Pareto superior outcomes through a decrease in certain types of transactions costs. We will focus specifically on informational problems which are some of the most common sources of transactions costs and inefficiencies in eco-
conomic environments. The efficiency costs of private information held by involved parties have been long recognized in the literature. Even in the presence of costless transfers, efficient outcomes are unlikely to be obtained due to the distortions caused by informational rents. There is a significant literature on this significant exception to the Coase theorem, especially showing how inefficient distortions are necessary in equilibrium to give the right incentives to the parties\textsuperscript{1}. In this paper, we will argue that the welfare distortions caused by private information in a series of bilateral agreements can be decreased when these negotiations are handled multilaterally. This is achieved through equalization of the marginal social cost of informational rents across different negotiations.

In an accompanying paper, Ozden [1998], we analyzed the efficiency gains that arise in a multilateral bargaining environment with perfect information. We showed that multilateral negotiations improve upon bilateral and/or regional agreements through allowing further cross-country trades and the internalization of externalities caused by discriminatory actions. As in the previous paper, we will set up a general bilateral bargaining game between governments acting in their self interest. In addition, we will assume that one of these governments has private information about certain parameter which would effect the outcomes implemented. This bargaining problem can be modelled as a mechanism design problem and any equilibrium outcome (optimal mechanism) of such a game needs to satisfy the incentive compatibility (IC) and individual rationality (IR) constraints. It is the (IC) constraints that lead to the efficiency losses through informational rents. In a bilateral setting, these constraints need to be satisfied for each party. We will, then, set up a special multilateral game in which the government with the private information holds independent negotiations with two governments. We, now, need to satisfy the sum of the (IR) and (IC) constraints. The marginal cost of the informational rent on the total welfare is unlikely to be equal in each bilateral mechanism. By equating these marginal costs in a multilateral setting, we can provide Pareto superior outcomes that were not available in a bilateral bargaining setting. The Pareto improvement is not due to the decrease in the informational rents that need to

\textsuperscript{1}See Kennan and Wilson [1993] for an extensive survey on bargaining with asymmetric information.
be paid to the government in return for revealing its private information, but due to the decrease in the overall distortions created by the rents. This kind of welfare improvement is an another benefit of the multilateral approach to trade negotiations and refutes the general claim that multilateral negotiations necessarily involve higher transactions costs and inefficiencies relative to a network of bilateral ones. Multilateral mechanisms can actually decrease inefficiencies arising due to one of the most serious problems trade negotiations, namely private information.

The next section will identify the fundamentals of the paper where the equilibrium conditions of bargaining under asymmetric information are identified. Then we will construct the multilateral bargaining game from two independent bilateral games. We will present the main result of the paper that for every outcome in a series of bilateral games there is a multilateral one that is Pareto improving. Then we will provide two examples of trade policy negotiations that demonstrate the main result. Conclusions will follow.

2 Fundamentals

In this section we will set up a basic mechanism design problem with one-sided private information and in the following sections we will turn to specific examples. The trade negotiation between two countries, A and B, will be our building block. The general payoff function for government A is given by

\[ u_b(x_b; y_b; \mu) = u_{x;b}(x_b; \mu) + u_{y;b}(y_b) \]  

where \( x \) and \( y \) are the two policy variables that the countries are negotiating over. A standard example would be tariff rates on imports from the other country. In the first example of the next section, these will be the volumes of imports and exports respectively. In the second example, it will be the terms of trade and date of implementation of the treaty. \( \mu \) is the parameter whose value is known only by government A: It can be interpreted as the weight
attached by the government to the welfare of certain groups in the society\textsuperscript{2}. We will refer to it as the type of A following the tradition in the literature. It lies in the interval $\mu_{i} \leq \mu \leq \mu_{h}$ with cumulative distribution function $F(\mu)$ and differentiable density $f(\mu)$. We will assume that the distribution of $\mu$ satisfies the monotone hazard rate:
\begin{equation}
\frac{d}{d \mu} \left( \frac{1}{f(\mu)} \right) > 0
\end{equation}

This property holds for many distribution functions, such as normal and uniform. Government B only knows the distribution of $\mu$, not its true value. We will assume that the following conditions hold for the payo\textsuperscript{*} function:
\begin{align*}
\frac{\partial u_{x;b}}{\partial x_{b}} &> 0; \frac{\partial u_{x;b}}{\partial \mu} \leq 0; \frac{\partial u_{y;b}}{\partial y_{b}} \leq 0
\end{align*}

Furthermore, the single crossing property is satisfied as well:
\begin{equation}
\frac{\partial u_{x;b}}{\partial x_{b}} \cdot 0; \frac{\partial u_{y;b}}{\partial y_{b}} \cdot 0
\end{equation}

The payo\textsuperscript{*} function for country B is given by
\begin{equation}
v(x_{b}; y_{b}) = v_{x}(x_{b}) + v_{y}(y_{b})
\end{equation}

where
\begin{align*}
\frac{\partial v_{x}}{\partial x_{b}} &> 0; \frac{\partial v_{y}}{\partial y_{b}} \leq 0
\end{align*}

At this point, we will introduce an artificial construct to our model. We will assume that there is a mediator who tries to coordinate the strategies of the two governments. The mediator helps the players communicate, share information and reach payo\textsuperscript{*}s that are Pareto superior to their inefficient default payo\textsuperscript{*}. We assume that the mediator can communicate separately and confidentially with each player. Every player is made a strategy recommendation by the mediator and no player is told of the strategy recommendations made to the other players. If a player does not obey the recommendations of the mediator then the whole

\textsuperscript{2}See Baldwin [1987] for the argument and Grossman and Helpman [1994] for a model that derives it in a lobbying context.
game will fall apart and he will receive his default payo®. Furthermore, we will assume that
the mediator solves a certain optimization problem and then communicates the optimal poli-
cies \((x_b; y_b)\) to the respective governments to be implemented. The objective function of this
problem will be increasing in the payo®s to the governments so that ine®cient policies will
never be implemented. Such a communication and implementation system with the medi-
tor can simulate any e®cient equilibrium of any bargaining game with any communication
system that the two governments can play to determine an outcome. This is the revelation
principle and is elaborated in great detail in many other sources. (Please see Myerson (1979)
for an initial introduction and Myerson (1994) for a general overview.)

The same arguments can be carried over to the Bayesian games where players have private
information which would require a two-way communication between the players and the
mediator. So we will consider a communication system of the following nature: Government
A is asked to report its type truthfully to the mediator; then the mediator recommends
an action \((x_b(\mu); y_b(\mu))\) to each player depending on this report. The concern is that A
might have an incentive to lie about its type and ignore the recommendation. This is the
incentive compatibility condition that has to be satis®ed by the direct revelation game. We
will assume that the mediator's problem is the same as above where he tries to maximize
the expectation of the weighted sum of the governments' payo®s subject to the incentive
compatibility constraint and the individual rationality constraints that require the suggested
policies to lead to payo®s higher than default payo®s:

\[
\max E_{\mu} [M (u_b (x_b; y_b); v (x_b; y_b))] \tag{2}
\]

\[
s.t. \quad u_b (x_b (\mu); y_b (\mu); \mu), \quad u_b x_b \beta; y_b \beta; \mu \quad \text{for all } \mu \beta 2 \mu \beta \leq \mu \beta
\]

\[
u_b (x_b (\mu); y_b (\mu); \mu), \quad u \quad \text{for all } \mu 2 \mu \quad \text{for all } \mu 2 \mu
\]

where \(M (u_b (x_b; y_b); v (x_b; y_b))\) is the objective function of the mediator and \(M_1 (: ) > 0; M_2 (: ) > 0\)
In this case, the revelation principle states that there is an equivalent incentive compatible and individually rational game with a mediator for any communication system (and therefore any extensive form bargaining game) where same policies are implemented and every type of player gets the exact same utilities. The mediator asks each player to truthfully reveal their types and, after he receives all of this information, recommends each one to play a certain strategy. So there is no loss of generality in focusing on the direct revelation game where there is two-way communication between the mediator and each player instead of a complicated bargaining game. (See Myerson (1994) and Fudenberg and Tirole (1992) for further details).

Since the single-crossing condition is satisfied for the payoff function and the monotone hazard rate condition holds for the distribution of \( \mu \), a necessary and sufficient condition for the existence of the policy pair \((x_b(\mu); y_b(\mu))\) that satisfy the incentive compatibility constraint is that \( x_b(\mu) \) be non-decreasing. Furthermore, any non-decreasing \( x_b(\mu) \) can arise in an equilibrium. Of course, it depends on the objective function of the mediator (or the underlying game being played) which specific \( x_b(\mu) \) will be implemented. Until we introduce the specific examples and the functional forms for the payoff functions, we will assume \((x_b^*(\mu); y_b^*(\mu))\) are the optimal policies that are implemented. Using the indirect utility function for country A, we can establish several properties of the optimal policies. Indirect utility function is given by

\[
U_b(\mu) = \max u_b x_b(\mu); y_b(\mu); \mu = u_b(x_b(\mu); y_b(\mu); \mu)
\]

and the envelope theorem yields that

\[
\frac{dU_b}{d\mu} = \frac{\partial u_b}{\partial \mu} = \frac{\partial u_{x;b}}{\partial \mu}
\]

From this we can derive the following:

\[
U_b(\mu) = u_b + \int \mu \frac{\partial u_{x;b}}{\partial \mu} x_b(\mu); y_b(\mu); d\mu
\]

Therefore, the utility of A will be increasing at a rate of \( \frac{\partial u_{x;b}}{\partial \mu} \) in any optimal policy mecha-
nism. Also, we can derive the optimal policy \( y_b(\mu) \) from the above equations:

\[
    u_{y;b}(y_b^*(\mu)) = U_b(\mu) + u_{x;b}(x_b^*(\mu);\mu)
\]

Given the definition of \( u_{y;b}(y_b) \) and above conditions, we can show that \( y_b^*(\mu) \) will be non-decreasing as well.

We will also introduce another bilateral negotiation that government A is involved in. Suppose A is also negotiating with country C on completely separate policies \((x_c; y_c)\), but the bargaining game is completely symmetric to the previous one. The payoff function from these policies for A is given by

\[
    u_c(x_c; y_c; \mu) = u_{x;c}(x_c; \mu) + u_{y;c}(y_c)
\]

and for C, it is denoted by

\[
    z(x_c; y_c) = z_x(x_c) + z_y(y_c)
\]

We will make the very strong assumption, that the only common thing in these negotiation is the private information parameter \( \mu \). Allowing \((x_b; y_b)\) to enter the payoff function of C complicates the analysis considerably and would distract from the main point. Furthermore, the presence of this kind of externalities should actually promote the argument in favor of multilateralism since we can internalize these externalities and would obtain further Pareto gains. However, even in this extreme case of independence, we will see that there are still gains to be obtained through coordination of policies. As it was the case in the negotiation with B; assume that \((x_c^*(\mu); y_c^*(\mu))\) are the polices that are implemented and the following conditions hold:

\[
    \frac{dU_c}{d\mu} = \frac{\partial u_c}{\partial \mu} = \frac{\partial u_{x;c}}{\partial \mu},
\]

\[
    U_c(\mu) = u_c + \frac{\partial u_{x;c}}{\partial \mu} x_c \frac{\partial}{\partial \mu} d\mu
\]

and

\[
    u_{y;c}(y_c^*(\mu)) = U_c(\mu) + u_{x;c}(x_c^*(\mu);\mu)
\]

As it was the case above, we can show that \( y_c^*(\mu) \) will be non-decreasing.
3 Multilateral Bargaining

The multilateral setting is simply the merger of the two independent bilateral negotiations between A, B and C. The payoff function for A is the sum of the functions from the two bilateral games while they are the same for B and C:

\[
\begin{align*}
U_A(x_b; y_b; x_c; y_c; \mu) &= u_b(x_b; y_b; \mu) + u_c(x_c; y_c; \mu) \\
&= u_{x;b}(x_b; \mu) + u_{y;b}(y_b) + u_{x;c}(x_c; \mu) + u_{y;c}(y_c) \\
V_A(x_b; y_b) &= v_k(x_b) + v_y(y_b) \\
Z_A(x_c; y_c) &= z_k(x_c) + z_y(y_c)
\end{align*}
\]

We will assume that \((x_b^\mu; y_b^\mu; x_c^\mu; y_c^\mu)\) is the outcome of the two separate bilateral games from the previous section. The main question of this section (and of the paper!) is the following: What are the conditions under which there is a trade policy vector \((x_b^m(\mu); y_b^m(\mu); x_c^m(\mu); y_c^m(\mu))\) that can Pareto improve upon this outcome and at the same time satisfy the incentive compatibility and individual rationality constraints (for all values of \(\mu\))?

We will not try to find the optimal policy in the multilateral setting, but simply show the existence of a Pareto superior outcome. The availability of Pareto gains will form the basis of our argument in favor of multilateral negotiations.

Individual rationality constraints are easy to satisfy since the new policies are supposed to be Pareto superior so we will ignore this condition. Now, we will try to construct the multilateral policy vector for a fixed \(\mu\). Suppose we change all policies marginally so that the following hold:

\[
\begin{align*}
x_b^m &= x_b^\mu + \delta x_b \\
x_c^m &= x_c^\mu + \delta x_c \\
y_b^m &= y_b^\mu + \delta y_b \\
y_c^m &= y_c^\mu + \delta y_c
\end{align*}
\]

Now, we will find the restrictions on these marginal changes. The incentive compatibility constraint in the multilateral game is simply the sum of the ones from the two individual ones from the bilateral games. \(U(\mu)\) will be defined as the indirect utility function of A in
the new setting. Then, the following has to hold for the new policies and for all values of \( \mu \):

\[
\frac{dU}{d\mu} (x^m_b; x^m_c) = \frac{dU_B}{d\mu} (x^m_b) + \frac{dU_C}{d\mu} (x^m_c)
\]

This implies the following:

\[
\frac{\partial u_{x;c}}{\partial \mu} (x^m_b) + \frac{\partial u_{y;c}}{\partial \mu} (x^m_c) = \frac{\partial u_{x;b}}{\partial \mu} (x^m_b) + \frac{\partial u_{y;c}}{\partial \mu} (x^m_c)
\]

or simply that

\[
\frac{u_{x;c}}{u_{y;b}} = \frac{u_{x;b}}{u_{y;c}} (x^m_b; \mu) \frac{u_{x;c}}{u_{y;c}} (x^m_c; \mu) \quad x; b
\]

when \( x; b \) and \( x; c \) are small\(^3\).

To show the presence of Pareto superior outcomes under multilateralism, we will hold the payoffs of A and B constant and see if we can increase the payoffs of government C. For government B to be indifferent between the bilateral and multilateral policy vectors, we need the following condition to hold:

\[
\frac{u_{x;b}^0 (x^m_b; \mu)}{u_{y;b}^0 (y^m_c; \mu)} = \frac{u_{x;c}^0 (x^m_c; \mu)}{u_{y;c}^0 (y^m_c; \mu)}
\]

For government A to be indifferent, the following needs to be satisfied:

\[
u^0_x (x^m_b) \quad y; b + u^0_y (y^m_c) \quad y; b + u^0_{x;c} (x^m_c; \mu) \quad x; c + u^0_{y;c} (y^m_c; \mu) \quad y; c = 0
\]

Substituting from the above two equations for \( u_{x;c} \) and \( u_{y;b} \), we obtain the following:

\[
\frac{u_{x;b}^0 (x^m_b; \mu)}{u_{x;c}^0 (x^m_c; \mu)} = \frac{u_{y;b}^0 (y^m_c; \mu)}{u_{y;c}^0 (y^m_c; \mu)} \quad x; b
\]

Finally, for the change in government C's welfare is given by

\[
z (x^m_c; y^m_c) \quad z (x^m_c; y^m_c) = z^0_x (x^m_c; \mu) \quad x; c + z^0_y (y^m_c; \mu) \quad y; c
\]

Substituting for \( x; c \) and \( y; c \) will give the following:

\[
z (x^m_c; y^m_c) \quad z (x^m_c; y^m_c) = 9 \quad \begin{array}{l}
\quad \frac{\partial u_{x;c}}{\partial \mu} (x^m_b; \mu) \frac{\partial u_{x;c}}{\partial \mu} (x^m_c; \mu) \quad z^0_x (x^m_c; \mu) \quad u^0_x (x^m_b; \mu) \quad u^0_x (x^m_c; \mu) \quad z^0_x (x^m_c; \mu) \quad z^0_y (y^m_c; \mu) \quad u^0_y (y^m_c; \mu) \quad u^0_y (y^m_c; \mu) \quad z^0_y (y^m_c; \mu) \quad z^0_y (y^m_c; \mu)
\end{array}
\]

\[
\quad x; b
\]

\[^3\text{In other words,} \quad \frac{\partial u_{x;b}}{\partial \mu} (x^m_b; \mu) \quad x; b
\]

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If the term in the brackets (which we will denote as $\phi$) is positive, we can increase $x_b^a(\mu)$ by some marginal amount $"_{x;b}$ for all $\mu$ and adjust the other policy variables $(y_b^a(\mu); x_c^a(\mu); y_c^a(\mu))$ marginally according to the conditions (3), (4) and (5). Governments A and B will be indifferent while C will gain. If $\phi$ is negative, we can implement the opposite. There is still the condition that $(x_b^m(\mu); x_c^m(\mu))$ be non-decreasing even after these changes so that incentive compatibility constraints are satisfied. If $\phi$ is uniformly positive (or negative) for all values of $\mu$, then we simply increase (decrease) $x_b^a(\mu)$ uniformly by a marginal amount and $x_b^m(\mu)$ will be non-decreasing as well. If $\phi$ changes signs depending on the value of $\mu$, we can still construct new Pareto superior policy vectors in the following manner. When the payoff functions are continuous, $\phi$ will be continuous as well. Suppose we have the following:

\[
\phi(\mu) = \begin{cases} 
8 > 0 & \text{when } \mu > \mu_b \\
9 = 0 & \text{when } \mu = \mu_b \\
9 < 0 & \text{when } \mu < \mu_b 
\end{cases}
\]

Then, define $x_b^m(\mu)$ as the following:

\[
x_b^m(\mu) = \begin{cases} 
8 \max(x_b^a(\mu) + "_{x;b}, x_b^a(\mu)) & \text{when } \mu > \mu_b \\
8 x_b^a(\mu) & \text{when } \mu = \mu_b \\
9 \max(x_b^a(\mu) + "_{x;b}, x_b^a(\mu)) & \text{when } \mu < \mu_b 
\end{cases}
\]

We are guaranteed that $x_b^m(\mu)$ will be non-decreasing as well when it is constructed in this manner. If we have more sign reversals in $\phi(\mu)$ we can perform the same exercise in constructing the $x_b^m(\mu)$. In short, it will be possible to provide Pareto gains in a multilateral framework compared to a bilateral one under all circumstances\(^4\).

Again, it is important to note two important points. First, the informational rents captured by A do not decrease, but we are simply decreasing the inefficient distortions caused by them. This is due to the fact that the incentive compatibility constraints under multilateralism is simply the sum of the constraints under bilateralism and the two bilateral

\(^4\)When we construct $x_b^m$ and $x_c^m$ in the above manner, in the case of sign reversals in $\phi(\mu)$ we are providing net gains only when $\mu \neq \mu_b$ and leaving the agents at the same payoff levels when $\mu = \mu_b$. 

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games are totally independent. Second, this is simply an existence result. The actual outcome of the multilateral game might be different. However, if participation is voluntary, each government needs to be guaranteed a payoff higher than their bilateral payoffs. Thus the rules of the multilateral negotiations need to be constructed to take this additional constraint into account.

4 Bargaining over trade volumes

In this section, we will apply above analysis into two specific examples. In the first one, country A and B will be negotiating over their bilateral trade volume. A variant of this framework was used by Feenstra and Lewis [1991] to analyze the negotiation of optimal bilateral trade policies in an asymmetric information setting. Suppose A imports good b from B which is produced and consumed only in these two countries. In return, A exports good a which serves as the numeraire. It is manufactured only with labor using constant return to scale production technology and its world and domestic prices are 1. Labor and an inelastically-supplied sector specific factor are used in the production of b in both countries. The reward to the producers of this good and the consumer demand for it depends only on its domestic price while the numeraire good absorbs all of the excess supply and demand. This structure enables us to use a partial equilibrium approach in a general equilibrium setting.

The domestic production of b is denoted by $q_b$ and the import volume (from B) by $x_b$. The price of b in A and B are denoted by $p_a$ and $p_b$ respectively. Supply of b in A and B are given by $q_b = s(p_a)$ and $s(p_b)$: The consumer surplus of b in A is given by

$$CS_A = \int (s(p_a) + x_b) \cdot p_a \ [s(p_a) + x_b]$$

where $^\prime (\cdot)$ is the utility function. Maximization by the consumers will enable us to write the domestic price as a function of the import volume $p_a = p_a(x_b)$. The producer surplus is denoted by

$$PS_A = \int s(p_a) \ dp_a$$
and the market clearing condition is
\[ s(p_A) + s(p_B) = d(p_A) + d(p_B) \]
where \( d(\cdot) \) are the demand functions derived from the utility functions. This will enable us to write \( p_B \) as a function of \( p_A \) and, therefore, as a function of \( x_b \): The tariff revenue will be
\[ TR_A = [p_A - p_B] x_b \]
The balanced trade condition will require the following to hold:
\[ p_B \cdot x_b = y_b \]
where \( y_b \) is the export of the numeraire good to country B.

Government A’s payo® is given by
\[ u = CS_A + (1 + \mu) PS_A + TR_A \]
where \( \mu \) reflects the extra weight attached to welfare of the producers due to lobbying. This is the standard method of introducing political economy motivations to the trade models. From substituting the definitions of the three welfare definitions into the above function (and the balanced trade condition), we would get
\[ u = 's(p_A) + x_b) p_A s(p_A + s(p_A) dp_A + \mu s(p_A) dp_A' y_b \]
When we substitute \( p_A(x_b) \) into the above function, the functional form will be identical to the payo® function in (1) in terms of \( x_b \) and \( y_b \). We will simply write the payo® for A as
\[ u_b(x_b; y_b; \mu) = v_b(x_b) + \mu^b(x_b) y_b \]
Similarly, we can write the following for B
\[ v(x_b; y_b) = v_b(x_b) + y_b \]
The political pressure parameter \( \mu \) is known only by government A and is the source of informational rents. If there were no private information, then the governments would simply
choose the $x_b$ that would maximize $\mathcal{R}(x_b) + \mu^-(x_b) + \nu_x(x_b)$ and choose the level of exports $y_b$ to distribute these gains. However, at such points $A$ will have the incentive to overstate $\mu$ and claim it to be at the highest possible value. Therefore, any equilibrium outcome needs to be incentive compatible. More specifically, we know that any outcome $x_b(\mu)$ will be non-decreasing. Finally, we should note that, we could formulate this bargaining in terms of prices (or tariffs) and the analysis would not change at all. Focusing on trade volumes enables us to treat the problem as if there is a costless transfer mechanism ($y_b$) which is easier to analyze.

Governments $A$ and $C$ are also engaged in a symmetric negotiation game in which we have the following payo® functions respectively:

$$u_c(x_c; y_c; \mu) = \mathcal{R}_c(x_c) + \mu^c(x_c) i y_c$$

$$z(x_c; y_c) = z(x_c) + y_c$$

Suppose $(x^a_b(\mu); y^a_c(\mu); x^c_b(\mu); y^c_c(\mu))$ are the outcomes of the bilateral trade negotiations and we would like to see how we can reach Pareto superior outcomes through multilateral negotiations. For any given $\mu$, equation (6) will be simplified to the following in this example:

$$\frac{dz(x^a_c; y^a_c)}{dx_b} = \frac{\mathcal{R}_b(x^a_b) + \mu^a_b(x^a_b) + \nu_y(x^a_b)}{\mathcal{R}_b(x^a_b)} i \frac{\mathcal{R}_c(x^c_b) + \mu^c(x^c_b) + z^c(x^c_b)}{\mathcal{R}_c(x^c_b)} (7)$$

This definition is very simple and intuitive to interpret. The expressions in the numerators are the marginal increases in the social welfare in either of the bilateral relationships in terms of the incentive compatible policy $x_b$. Since the socially optimal policy will never be adopted (except when $\mu = \hat{\mu}$), these terms will always be positive. In other words, in equilibrium, we need to sacrifice social welfare to give the right incentive to $A$. This is the welfare cost of informational rents that $A$ captures. The expressions in the denominators are the marginal change in informational rents that $A$ receives in each bilateral game and these are positive as well. Thus the "rst (second) term in the above expression is the "price" of social welfare in terms of $A$'s welfare at any incentive compatible outcome in his bilateral relationship with government $B$ ($C$). If the price of social welfare is higher (lower) in the "rst bilateral game
compared to the second one, we can provide Pareto gains through increasing (decreasing) \( x_b \) while we decrease (increase) \( x_c \) to keep A's incentives for truth telling. Furthermore, one can show that the above expression will be uniformly positive or negative regardless of the value of \( \mu \) once we restrict ourselves to mediator's objective functions in (2) that are increasing in both arguments (that are efficient given the incentive constraints). This implies that we need to uniformly increase (or decrease) \( x_b^* \) to obtain Pareto superior outcomes. These Pareto gains are simply obtained through the decrease in the welfare distortions caused by incentive constraints due to private information.

5 Delay in reaching an agreement

One of the most important costs in bargaining environments is the time it takes to reach an agreement. These costs might be the opportunity costs of the delayed receipt of the gains from the agreement and/or expenses incurred during the bargaining process. Although delays are always inefficient ex post (after all the information is revealed in truth telling equilibrium), they might be necessary ex ante to establish credibility and reach an optimal outcome (given the incentive constraints). Negotiations over trade policies are no exception and the example in this section will involve such costs. We will be focusing on the opportunity cost of delayed outcomes although trade negotiations can be quite expensive as well\(^5\). In this case, we will assume that A and B trade two commodities that are produced and consumed only in these two countries. The purpose of their is to determine their terms of trade (price of A's exports over it imports) which is denoted as \( x_b \). The payo® functions for governments A and B from an agreement setting terms of trade at \( x_b \) and signed at time \( t_b \) are given by

\[
\text{u}_b (x_b; t_b; \mu) = \text{u}_b (x_b; \mu) - r t_b
\]

\(^5\)Since Geneva is one of the most expensive cities in the world, most developing countries cannot afford to have a permanent representative in the WTO. They tend to send their representatives for brief periods during important negotiations from other embassies in Europe and they have the incentive to conclude the negotiations as soon as possible.
\[ v(x_i; t_i) = v(x_i) i r t_i \]

For simplicity, we will analyze the payoff functions in logarithmic form. In the above expressions, \( r \) is the symmetric discount rate and \( \mu \) is the information parameter known only by government A. We will assume that single-crossing and monotone hazard properties hold and therefore, optimal non-decreasing policies \( x_i(\mu) \) are implementable. Similarly, A holds negotiations with C over their terms of trade and the relevant payoff functions are

\[
\begin{align*}
    u_c(x_c; t_c; \mu) &= u_b(x_c; \mu) i r t_c \\
    z(x_c; t_c) &= z(x_c) i r t_c
\end{align*}
\]

We will assume that \((x_b^*(\mu); x_c^*(\mu); t_b^*(\mu); t_c^*(\mu))\) is the outcome of independent bilateral negotiations. The question, we will answer is the following: Is there a new trade policy vector \((x_b^m(\mu); x_c^m(\mu))\) signed at time \( t^m(\mu) \) that is Pareto superior to the bilateral outcome? For any given \( \mu \), equation in (6) yields the following condition:

\[
\frac{dz(x_c^m; t_c^m)}{dx_b} = \frac{v^0(x_b^m)}{\partial u_b(x_b^m; \mu)} = \frac{u_b(x_b^m; \mu)}{\partial u_b(x_b^m; \mu)} = \frac{z^0(x_c^m)}{\partial u_c(x_c^m; \mu)} = \frac{u_c(x_c^m; \mu)}{\partial u_c(x_c^m; \mu)} \tag{8}
\]

Following the same steps, we can also calculate the change in A's payoff when we keep B and C's payoffs constant and satisfy the incentive compatibility constraint. Since there are no costless transfers available in this setting unlike the previous example, this condition is more difficult to evaluate initially. Recall that the indirect utility function for A in its bilateral relationship with B can be written as

\[
U_b(\mu) = \max x_b^3 \mu^3 \hat{\mu} \quad rt_b^3 \mu \quad = u_b(x_b(\mu); \mu) i r t_b(\mu)
\]

and the total social welfare is given by

\[
W_b(x_b; t_b; \mu) = u_b(x_b; t_b; \mu) + v_b(x_b; t_b) = u_b(x_b; \mu) i r t_b(\mu) + v(x_b) i r t_b
\]

Substituting from the indirect utility function for \( t_b(\mu) \); we obtain

\[
W_b(x_b; t_b; \mu) = 2U_b(\mu) + v(x_b) i u_b(x_b; \mu)
\]
Now, we will calculate the change in total social welfare in this bilateral relationship when we change \( x_b \) marginally at a given \( \mu \). We should remember that incentive compatibility condition requires that the change in the indirect utility level stays the same whether we are in a bilateral or multilateral environment at a given \( \mu \). This implies that

\[
\frac{dU_b}{dx_b} = 0
\]

for all incentive compatible policies \( x_b \). So the change in social welfare is given by

\[
\frac{dW_b}{dx_b} = v^0(x^*_b) - u^0_b(x^*_b, \mu)
\]

which is the expression in the numerator of expression in (8). The numerator is the increase in the rent \( A \) receives when we change \( x_b \). The total expression is again the relative \"price\" of social welfare in terms of \( A \)'s welfare in any incentive compatible trade policy outcome which is the identical expression in the previous example given in condition (7). Efficiency requires that we should increase (decrease) \( x_b \) if the marginal increase social welfare is higher (lower) in the 1st bilateral game compared to the second one. Such changes will provide Pareto superior outcomes while they sustain incentive compatibility. In other words, for any pair of bilateral agreements that involve delay due to informational constraint, there is a multilateral outcome which is Pareto superior. This outcome does not involve a decrease in \( A \)'s complete payo®(including the cost of delay), but simply a decrease in the distortion caused by the incentive constraints.

6 Conclusion

The aim of this paper was to question the widely held belief that multilateral negotiations necessarily involve higher transactions costs. This claim has been used by opponents of multilateral e@orts in favor of bilateral and/or regional arrangements, especially within the United States. In this paper, we focus on one of the most important sources of transactions costs (and economic inefficiencies) in bargaining environments, namely informational
asymmetries. There is widespread empirical evidence and rigorous theoretical analysis that show many forms of inefficiencies can arise when one or (both) of the parties have private information that can affect the optimal outcome. These costs are necessary for the truthful revelation of the private information in equilibrium and arise through the implementation of Pareto inferior policies and/or delay in reaching an agreement.

The revelation principle states that any equilibrium of any extensive bargaining game between governments can be modeled as a communication game with a mediator (with the appropriate objective function) that needs to satisfy incentive compatibility (IC) and individual rationality constraints (IR). The IC constraints lead to informational rents captured by the government with the private information (A) and to decreases in the social welfare. Then we constructed a multilateral game through joining of two independent bilateral games that are played by A and two other governments. In the case of perfect information with no externalities and no cross-country trades, there would be no gains from multilateralism since all sources of efficiency would be exploited. However, in this case, we can easily construct Pareto superior outcomes that are also incentive compatible in the new game. The Pareto improvements simply arise through a decrease in the distortions caused by informational rents (which actually stay the same.) We provided two examples of trade negotiations in which these results become more clear. First one involves negotiations over trade volumes (which is equivalent to negotiations over tariffs) and the second has delay in reaching an agreement. In both cases, Pareto gains are obtained through equalization of the relative price of social welfare in terms of informational rents across bilateral games.

An important simplification in these examples (and our framework) is the strong independence of the bilateral games from each other, in other words, there are no externalities imposed by the agreement between A and B on country C. Although, we argued that the internalization of such externalities forms one of the main motivations for holding multilateral negotiations in the perfect information setting of Ozden [1998], they would impose technical difficulties in the private information setting. However, the presence of such externalities would make the case for multilateral approach to trade liberalization even stronger.
Another interesting and more realistic extension would be the introduction of two-sided asymmetric information where all parties have private information. This analytically rather difficult problem is an avenue we are exploring for a future draft of the paper. An interesting preliminary result is that, under certain circumstances, the efficiency gains imply decreases in informational rents.
References


