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## SOME WORRYING THEORETICAL CONSEQUENCES OF THE NON-LINEAR RELATIONSHIP BETWEEN THE ECONOMIC SIZE OF PREFERENTIAL TRADE AGREEMENTS AND WELFARE

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### Abstract:

This paper demonstrates that in the standard Viner-Lipsey customs unions analysis, there is a non-linear relationship between welfare and the economic size of preferential trade agreements. It is concluded that signing preferential trade agreements with countries that have a large trade potential is likely to improve welfare, but that a minimum economic size threshold may be required for such outcome. Otherwise, preferential trade agreements may reduce welfare. The paper also demonstrates that within that framework, the lower the trade barriers towards non-member countries, the greater the economic size that may be required for preferential trade agreements to be welfare improving. This theoretical paper suggests that if small countries follow preferential trade agreement strategies such as those applied by the European Union, and more recently by the United States, Mexico and Chile, they should do so with care, clear objectives and national commitment.

Key Terms: Economic integration, preferential trade agreements, trade creation, trade diversion.

JEL Classification: F15.

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# **ALGUNAS CONSECUENCIAS PREOCUPANTES DE LA RELACIÓN NO LINEAL ENTRE EL TAMAÑO DE LOS ACUERDOS PREFERENCIALES DE COMERCIO Y EL BIENESTAR**

## **Resumen:**

Este documento demuestra que en el análisis convencional de uniones aduaneras de Viner-Lipsey, hay una relación no-lineal entre el bienestar y el tamaño de los acuerdos preferenciales de comercio. Se concluye que la firma de acuerdos preferenciales de comercio que tienen un potencial de comercio grande puede mejorar el bienestar, pero que es necesario sobrepasar un tamaño crítico para que ello ocurra. De lo contrario, los acuerdos preferenciales de comercio pueden reducir el bienestar. El documento también muestra que dentro de ese marco, entre más bajas sean las barreras al comercio hacia los países no miembros, más grande debe ser el tamaño económico requerido para que los acuerdos preferenciales de comercio mejoren el bienestar. Este documento teórico sugiere que si países pequeños deciden seguir estrategias de apertura con la firma de acuerdos preferenciales, tales como las aplicadas por la Unión Europea, y más recientemente por los Estados Unidos, México y Chile, deberían hacerlo con cuidado, objetivos claros y como parte de un compromiso nacional

Palabras clave: Integración económica, acuerdos preferenciales de comercio, creación de comercio, desviación de comercio.

Clasificación JEL: F15.

## I. INTRODUCTION

Over the last 50 years there has been a significant proliferation of preferential trade agreements (PTAs) around the world. Some of them integrate fairly large economies, such as the European Union and the North American Free Trade Area, but several of them integrate small countries. It is almost common knowledge among trade economists that the larger the economic size of a PTA, the more likely that it will be welfare improving.

For example, Winters (1991) states that “a customs union will tend to be more beneficial (...) the larger the union, because then there is more chance of including the least cost producer”. Robson (1998) argues that “The larger is the economic area of the customs union, and the more numerous are the countries of which it is composed, the greater will be the scope for trade creation as opposed to trade diversion”. And Jovanovic (1998) points out that “the larger the number of countries that participate in a customs union, the smaller the probability of trade diversion”.

In order to refine such common knowledge, this paper derives a formal relationship between the size of PTAs and welfare. The paper argues that welfare is likely to be non-linear in a country's trade potential. Thus, increasing the size of preferential trade agreements may lead to a welfare loss in the early stages, and a minimum threshold size may be required in order for welfare to increase. It is also shown that the lower the trade barriers with the rest of the world, the higher the level of welfare of a country that belongs to a PTA, but the larger the economic size of its PTAs required to increase welfare.

## II PREVIOUS LITERATURE<sup>2</sup>

The building block of the theory of PTAs is the theory of customs unions, which in turn can be generalised to other forms of international integration such as free trade agreements.

### A. Static Effects

The two key pillars of the theory of customs unions are the concepts of trade creation and trade diversion.

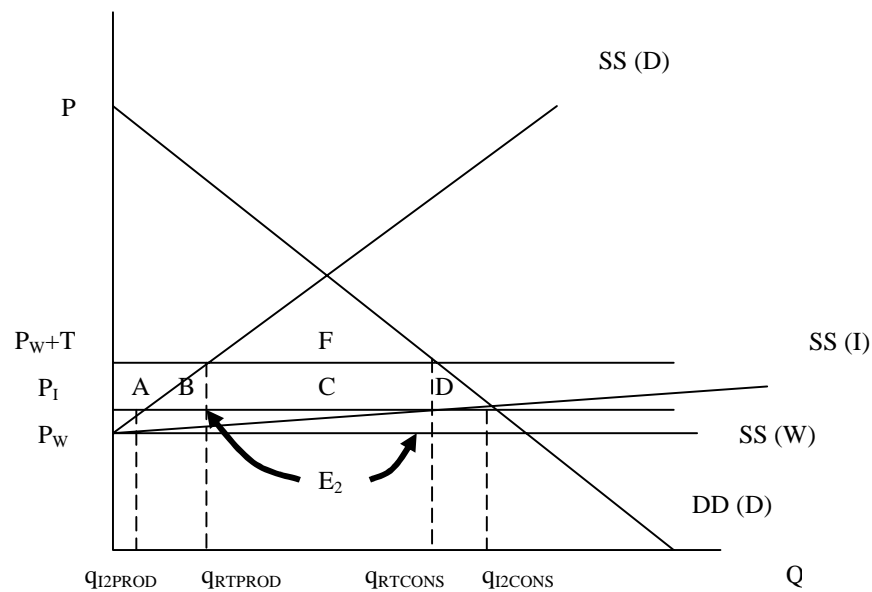
In the case of changes in imports due to preferential trade agreements, trade creation refers to the substitution of high cost domestic suppliers by lower cost suppliers from member countries, due to the change in trade barriers. This trade creation can be seen both in terms of production effects, as described by Viner (1950), and consumption effects, as proposed by Meade (1956), Gehrels (1956) and Lipsey (1960). On the other hand, trade diversion refers to the substitution of low cost suppliers of imported goods from non-member countries, by higher cost suppliers from member nations, caused by the reduction in trade barriers between the members of the economic integration agreement.

Figure 1 describes the trade creation and trade diversion effects for a country that imports a product.

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<sup>2</sup> For fairly recent surveys on international economic integration see Hine (1994), El-Agraa (1997a), Jovanovic (1998) and Robson (1997). Also, Nicholls (1995) has a very complete survey on the theory of customs unions.

**FIGURE 1**  
**TRADE CREATION AND TRADE DIVERSION EFFECTS**



where

- $CONS$  = Consumption sub-index.
- $DD_D$  = Domestic demand.
- $I$  = Integration sub-index.
- $P$  = Price.
- $PROD$  = Production sub-index.
- $q$  = Quantities.
- $RT$  = Restricted trade sub-index.
- $SS_D$  = Domestic supply.
- $SS_I$  = Supply under integration.
- $T$  = Trade barriers.
- $W$  = World sub-index.

Trade creation is represented by both the decrease in local production reflected in the segment  $q_{IPROD}$  to  $q_{RTPROD}$ , and the increase in domestic consumption shown

by the segment  $q_{RTCONS}$  to  $q_{ICONS}$ , whose welfare effects are represented by the triangles (B) and (D) respectively.

Trade diversion is reflected by the greater amount of foreign exchange paid for the previous quantity of imports, a negative welfare effect reflected by rectangle (E). Thus, the net welfare effect is triangles (B) plus (D) minus rectangle (E)<sup>3</sup>.

It is worth mentioning that, as is common in the theory of commercial policy, the previous analysis is partial equilibrium. Lipsey (1960) has pointed out that such an analysis is still valid in the general equilibrium case where changes in trade barriers are marginal, but that it may not be valid for non-marginal changes in trade barriers.

One additional element worth bearing in mind is that the effects of the removal of trade barriers may go beyond the members of a commercial integration agreement. This is best described in terms of trade modification as defined by Ethier and Horn (1984). If trade integration leads to an increase in the exchange of a good that has complement commodities which are traded with non-member countries, bilateral trade of the complementary goods with non-member nations could eventually increase as a result of the trade agreement.

The typical example<sup>4</sup> would be an integration scheme in which vehicles are traded more intra-regionally because of the trade agreement, and that in turn, may lead to greater imports of petrol from non-member countries. This type of complementarity would tend to decrease the relative positive effect of the trade agreement on the volume of bilateral trade between two countries that are

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<sup>3</sup> The analysis of the welfare impacts of economic integration has its subtleties. For example, although trade creation and trade diversion are correspondingly associated with welfare improvements and welfare losses, some authors claim that under certain circumstances trade diversion may lead to welfare improvements [Johnson (1965) & Corden (1972)].

<sup>4</sup> The next two examples are taken from Winters (1991).

members of a trade agreement, with respect to the bilateral trade between a member country and a non-member nation.

On the other hand, if there is substitutability between goods traded intra-regionally and extra-regionally, as could be the case with margarine and butter, then regional integration may lead to lower bilateral trade in the substitute commodities with non-member countries. This substitutability would re-enforce the relative positive effect of the trade agreement on the volume of bilateral trade between the two member countries.

Finally, it may be worth mentioning that behind the relatively greater trade between members of a PTA, as opposed to non-members, caused by lower trade barriers, there may lie factors such as comparative advantage, product differentiation [Krugman (1990)] and oligopoly [Brander and Krugman (1990)], the last two closely related to increasing returns to scale.

## B. Dynamic Effects

Economic integration can also have dynamic effects, as was pointed out by Baldwin (1989 and 1992). These effects are caused by factors such as the greater investment in member countries once integration is agreed, the exploitation of economies of scale, the greater R & D carried out in societies with higher standards of living, etc. For a summary of some of the main dynamic effects of economic integration, see Hine (1994).

Note as well that these dynamic effects may feed through to non-members of a regional trade agreement. If regional integration leads across time to higher levels of income, this in turn may increase the level of bilateral trade between members and non-member countries because of higher supply potential (in the case of exports) and higher demand potential (in the case of imports). Thus, *ceteris*

*paribus*, this effect would tend to decrease across time the relative positive impact of a trade agreement on the bilateral trade of two member nations as measured by, say, the coefficient of a dummy variable included in a gravity regression.

This paper focuses on the static effects of customs unions in small economies. According to data from the World Bank's World Development Indicators (2003), on average between 1997 and 2001, only 7 countries out of 186 had GDPs greater than 2.15% of the world's GDP.

### III. MODEL

This paper uses the standard Viner-Lipsey partial equilibrium framework to analyse the effects of the economic size of preferential trade agreements on a country's welfare.

The main ideas underlying the model developed here are:

- Small PTAs generate trade diversion, but since the member nations are also small, the extent of that trade diversion is not too big.
- Large PTAs also generate trade diversion, but since the non-member nations (or rest of the world) are small, the extent of that trade diversion is also small.
- Since focus is on small countries, international prices are given. And since there are no externalities, welfare is non-decreasing as trade barriers with the rest of the world are lowered, *ceteris paribus*.
- The smaller the trade barriers with the rest of the world, the larger the PTAs of a small nation have to be in order to lower imported goods prices. Since it is those lower prices that generate trade creation (more consumption and lower inefficient production), the smaller the trade barriers with non-member



countries, the larger the PTAs have to be in order to reduce prices and increase welfare.

In order to present the model, the notation used will be described first, followed by the assumptions, the structure of the model and then a summary of the results obtained.

#### A. Notation

$a$	=	Domestic demand intercept.
$B$	=	Production welfare effect.
$b$	=	Domestic demand slope.
$c$	=	Domestic supply intercept.
$D$	=	Consumption welfare effect.
$d$	=	Domestic supply slope.
$E$	=	Trade diversion welfare effect.
$F$	=	Welfare effect of moving from autarky to restricted trade.
$f$	=	Slope of the supply curve under preferential trade agreements.
$FT$	=	Free Trade sub-index.
$MP$	=	Import potential.
$NWE$	=	Net welfare effect of a PTA.
$p$	=	Price.
$PR$	=	Prohibitive trade barrier sub-index.
$R$	=	Government revenue under restricted trade.
$W$	=	Welfare level reached after normalizing the autarky welfare level to zero.
$1$	=	Integration phase 1 sub-index.
$2$	=	Integration phase 2 sub-index.

With the rest of the variables defined as before.

## B. Assumptions

The basic assumptions of the model used in this paper are:

- (i) Countries are small, and thus, price takers.
- (ii) Markets are competitive.
- (iii) Transport costs are zero.
- (iv) There are no externalities.
- (v) Countries have either:
  - Restricted trade with no discrimination between nations.
  - Free trade with the members of preferential trade agreements and restricted and non discriminatory trade with non-member nations.
- (vi) Trade restrictions apply only to imports. There are no domestic export distortions.

## C. Equilibrium<sup>5</sup>

Basic structure of the model is given by domestic linear demand and supply curves:

$$DD : p = a - bq$$

$$SS : p = p_w + dq$$

Autarky equilibrium ( $p_A$ ,  $q_A$ ) is:

$$q_A = \frac{a - p_w}{b + d}$$

$$p_A = \frac{ad + bp_w}{b + d}$$

The free trade equilibrium ( $p_{FT}$ ,  $q_{FTCONS}$ ,  $q_{FTPROD}$ ) is:

$$p_{FT} = p_W$$

$$q_{FTCONS} = \frac{a - p_W}{b}$$

$$q_{FTPROD} = 0$$

The restricted trade equilibrium ( $p_{RT}$ ,  $q_{RT}$ ,  $q_{RT}$ ) is:

$$p_{RT} = p_W + T$$

$$q_{RTCONS} = \frac{a - p_W - T}{b}$$

$$q_{RTPROD} = \frac{T}{d}$$

The prohibitive trade barrier ( $T_{PR}$ ) is:

$$T_{PR} = \frac{d(a - p_W)}{b + d}$$

$$T_{PR} \% = \frac{d(a - p_W)}{p_W(b + d)}$$

The regional integration equilibrium is determined by the supply with integration<sup>6</sup>.

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<sup>5</sup> Detailed algebraic procedures are available from the author upon request. When fractions appear, parameters are assumed to be defined in such a way that denominators are different from zero.

<sup>6</sup> Note that the way the model is set up allows to analyze from having no PTAs, all the way to having PTAs with all of the world's countries, simply by changing the value of  $f$  between  $d$  and 0. Obviously,  $f = d$  represents a nation with no PTAs,  $f = 0$  represents free trade, and  $0 < f < d$  represents PTAs between those two extremes.

$$OO_I : p = p_w + fq$$

$$0 < f < d$$

Such equilibrium can be described in two scenarios, which will be called here phase 1 (or trade diversion phase) and phase 2 (or trade creation - trade diversion phase). The two phases are separated by the case where

$$f^* = \left[ \frac{bT}{a - p_w - T} \right]$$

which is the ratio of the trade barrier over the consumption under restricted trade, that gives the slope of the supply curve under integration that maximizes trade diversion.

$$f^* = \left[ \frac{b}{\frac{a - p_w}{T} - 1} \right]$$

So

$$\frac{\partial f^*}{\partial T} > 0$$

This means that the lower the trade barriers with the rest of the world, the larger the size of a PTA (the smaller the  $f$ ) that maximizes trade diversion, i.e., that minimizes welfare.

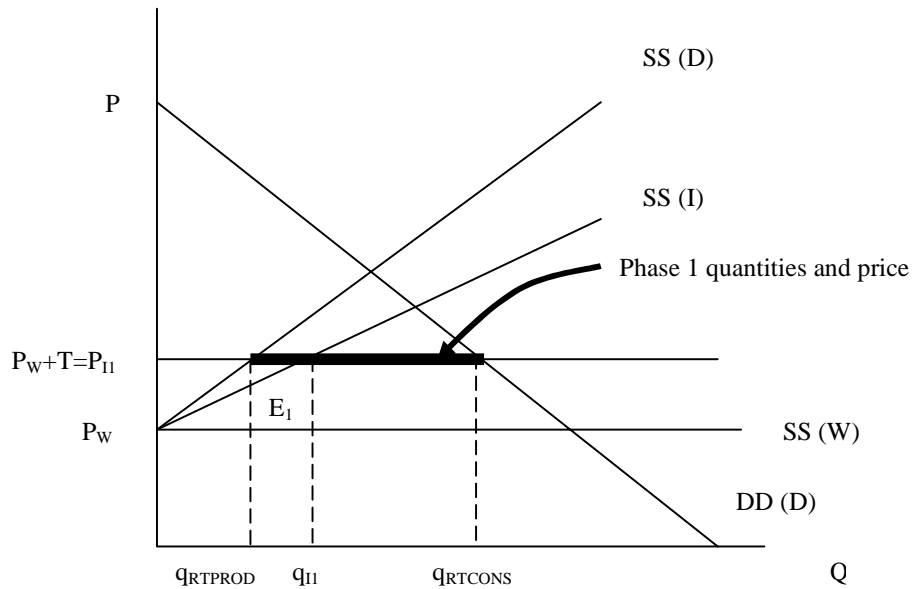
Thus, the phase 1 equilibrium ( $p_{11}$ ,  $q_{11C}$ ,  $q_{11P}$ ), shown in figure 2, occurs if

$$\left[ \frac{bT}{a - p_w - T} \right] < f < d$$

$$p_{I1} = p_w + T$$

$$q_{I1} = \frac{T}{f}$$

FIGURE 2  
EQUILIBRIUM UNDER PREFERENTIAL TRADE AGREEMENTS IN PHASE 1



As  $P_{I1} = P_w + T$ , domestic consumption and production in phase 1 are the same as with restricted trade<sup>7</sup>. Thus,

$$q_{I1CONS} = q_{RTCONS} = \frac{a - p_w - T}{b}$$

$$q_{I1PROD} = q_{RTPROD} = \frac{T}{d}$$

<sup>7</sup> Note that  $q_{I1} = q_{I1PROD} + \text{imports from PTA members}$ .

The phase 2 equilibrium  $(p_{12}, q_{12C}, q_{12P})$ , shown in figure 3, occurs if:

$$0 < f < \left[ \frac{bT}{a - p_w - T} \right]$$

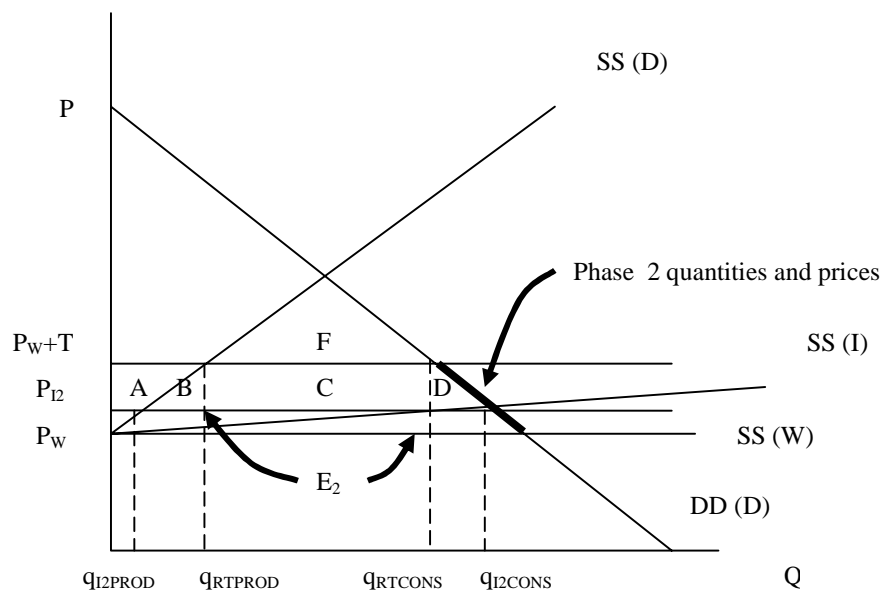
$$q_{12CONS} = \frac{a - p_w}{(b + f)}$$

$$p_{12} = \frac{af + bp_w}{b + f}$$

$$q_{12PROD} = \frac{f(a - p_w)}{d(b + f)}$$

FIGURE 3

**EQUILIBRIUM UNDER PREFERENTIAL TRADE AGREEMENT IN PHASE 2**



D. Welfare Measures.

Before focusing on the welfare analysis of PTAs, it is convenient to define a series of welfare measures. As shown in figure 3, the increase in welfare of moving from autarky to restricted trade is:

$$F = \frac{1}{2} \left[ p_A - P_{RT} \right] \left[ q_{RTCONS} - q_{RTPROD} \right]$$

$$F = \left[ \frac{\left[ d \left( a - p_w \right) - T \left( b + d \right) \right]^2}{2bd \left( b + d \right)} \right] \quad (1)$$

And the tariff<sup>8</sup> collection under restricted trade as:

$$R_{RT} = T \left[ q_{RTCONS} - q_{RTPROD} \right]$$

$$R_{RT} = \frac{d \left( a - p_w \right) T - \left( b + d \right) T^2}{bd} \quad (2)$$

In phase 1 of a PTA there is a welfare fall of  $E_1$ , as shown in figure 2:

$$E_1 = T * \left[ q_{I1} - q_{RTPROD} \right]$$

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<sup>8</sup> The terms tariffs and trade restrictions are used as synonyms in this paper. Tariffs can be thought of as tariff equivalents of trade restrictions, and tariff revenues can be thought of as government revenue plus rents from other trade restrictions.

$$E_1 = \frac{T^2}{f} - \frac{T^2}{d} \quad (3)$$

In phase 2, the net effect on welfare will be  $B+D-E_2$ , which can be measured as:

$$B = \frac{\left[ p_w + T - p_{I2} \right] * \left[ q_{RTPROD} - q_{P12 PROD} \right]}{2}$$

$$B = \frac{\left[ T(b+f) - f(a-p_w) \right]^2}{2d(b+f)^2} \quad (4)$$

$$D = \frac{\left[ p_w + T - p_{I2} \right] * \left[ q_{I2CONS} - q_{RTCONS} \right]}{2}$$

$$D = \frac{\left[ T(b+f) - f(a-p_w) \right]^2}{2b(b+f)^2} \quad (5)$$

$$E_2 = \left[ p_I - p_w \right] * \left[ q_{RTCONS} - q_{RTPROD} \right]$$

$$E_2 = \left[ \frac{\left( fd \right) \left( a - p_w \right)^2 - \left( fT \right) \left( a - p_w \right) \left( b + d \right)}{bd(b+f)} \right] \quad (6)$$

The net welfare effect (NWE) of a PTA in phase 2 is:



$$\begin{aligned}
NWE &= \left[ \frac{\left[ T(b+f) - f(a-p_w) \right]^2}{2d(b+f)^2} \right] + \left[ \frac{\left[ T(b+f) - f(a-p_w) \right]^2}{2b(b+f)^2} \right] - \left[ \frac{\left( fd(a-p_w) \right)^2 - \left( fT(a-p_w)(b+d) \right)}{bd(b+f)} \right] \\
NWE &= \frac{\left( b+d \right) \left( b+f \right)^2 T^2 + f^2 \left( a-p_w \right)^2 \left( b+d \right) - 2 \left( b+f \right) \left( fd \right) \left( a-p_w \right)^2}{2bd(b+f)^2} \quad (7)
\end{aligned}$$

Let the PTA Welfare Threshold Frontier (*WTF*) be defined as the combinations of trade barriers and market size, such that the net welfare effect is zero, i.e. combinations of trade barriers that maintain the original level of welfare. Such *WTF* occurs only in phase 2 and can be found by setting equation (7) equal to zero and solving for  $T$ :

$$T = \sqrt{\frac{f(a-p_w)^2 \left[ 2bd + f(d-b) \right]}{\left( b+d \right) \left( b+f \right)^2}} \quad (8)$$

In order to express changes in  $f$  as changes in the import potential (*MP*) of a trade agreement, *MP* is defined as imports under integration in phase 1 or 2 ( $M_{I1}$  or  $M_{I2}$ ) as a proportion of imports under free trade ( $M_{FT}$ ), which are equal to free trade consumption, given that free trade production is assumed to be zero:

$$MP_{11} = \frac{bT(d-f)}{df(a-p_w)}$$

$$MP_{12} = \frac{b(d-f)}{d(b+f)} \tag{9}$$

#### IV. THEOREMS

Within the framework developed so far and bearing in mind that *NWE* refers to the net welfare effect of a PTA, while *W* refers to the level of welfare reached by a country given that the welfare under autarky has been normalized to zero, the following theorems can be proved.

*The Non-Linear Welfare Theorem:* Given the assumptions of the model, there is a non-linear relationship between welfare and the economic size of a preferential trade agreement.

*Proof:*

In phase 1, recalling that  $f^*$  represents the size of a PTA that separates phase 1 and phase 2, and using equation (3):

$$\left. \frac{\partial E_1}{\partial f} \right|_{f^* < f < d} = -\frac{T^2}{f^2} < 0$$

The larger the market size (the lower  $f$ ), the larger the trade diversion and the lower the welfare in phase 1.

In phase 2, using equation (7) and given that with a PTA  $0 < f < d$

$$\left. \frac{\partial NWE}{\partial f} \right|_{0 < f < f^*} = b^2 (f - d) < 0$$

Thus, the larger the market size (the lower  $f$ ), the larger the positive net welfare effect in phase 2. So, the impact of the size of PTAs on welfare depends on the phase in which a country is located, and is non-linear.

Q.E.D.

*The Non-Decreasing Welfare Theorem:* Given the assumptions of the model, the level of welfare of a member of a PTA with respect to its level of welfare in autarky, will be non-decreasing, as the level of trade barriers to non-member countries falls.

*Proof:*

Normalizing the level of welfare in autarky to zero, using equations (1), (2) and (3), and as long as  $f < d$ , in phase 1 the level of welfare is  $W = F + R_{RT} - E_1$ . Expressing the  $T$  that splits phase 1 and phase 2 as

$$T^* = \frac{f(a - p_w)}{(b + f)}$$

$$\left. \frac{\partial W}{\partial T} \right|_{0 < T < T^*} = - \left[ \frac{d(a - p_w) - T(b + d)}{bd} \right] + \left[ \frac{d(a - p_w) - 2T(b + d)}{bd} \right] - 2T \left( \frac{1}{f} - \frac{1}{d} \right)$$

$$\left. \frac{\partial W}{\partial T} \right|_{0 < T < T^*} = - \frac{T(b + d)}{bd} - 2T \left( \frac{1}{f} - \frac{1}{d} \right) < 0$$

Thus, the lower the trade barriers ( $T$ ), the higher the level of welfare in phase 1.

In phase 2, and using equations (1), (2), (4), (5) and (6), the level of welfare in phase 1 with respect to autarky is  $W = F + R_{RT} + B + D - E_2$ :

$$\left. \frac{\partial W}{\partial T} \right|_{T^* < T < T_{PR}} = \frac{-T(b + d) + (b + d)T}{bd} = 0$$

Welfare is unchanged<sup>9</sup> regardless of the level of trade barriers, as long as the country is in phase 2. Thus, lower trade barriers either increase welfare (as in phase 1) or leave it unchanged (as in phase 2).

Q.E.D.

*The Free Trade Corollary.* Given the proof of the *Non-Decreasing Welfare Theorem*, free trade maximizes the level of welfare of a given country.

*Proof.*

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<sup>9</sup> The change in the level of welfare is zero given that a higher  $T$  increases the welfare generated by the PTA, but decreases the level of welfare under restricted trade, and the two effects cancel each other out.

$$\lim_{T \rightarrow 0} f^* = 0$$

Thus, as  $T$  is lowered, countries enter phase 1. And in phase 1

$$\left. \frac{\partial W}{\partial T} \right|_{0 < T < T^*} = -\frac{T(b+d)}{bd} - 2T \left( \frac{1}{f} - \frac{1}{d} \right) < 0$$

So the lower the trade barriers, the higher the welfare. And

$$\lim_{T \rightarrow T_{PR}} f^* = d$$

This means that as  $T$  is increased, countries enter phase 2. And in phase 2 the level of welfare remains unchanged, since

$$\left. \frac{\partial W}{\partial T} \right|_{T^* < T < T_{PR}} = \frac{-T(b+d) + (b+d)T}{bd} = 0$$

Thus, the highest possible welfare is achieved under free trade.

Q.E.D.

*The PTA Enlargement Theorem:* Given the assumptions of the model, the lower the level of the trade barriers, the larger the economic size of a PTA required for welfare to remain unchanged or to increase:

*Proof:*

Using equation (8)

$$\frac{\partial T}{\partial f} = \frac{\frac{b(a - p_w)^2 [b(d - f)]}{(b + d)(b + f)^3}}{\left[ \frac{f(a - p_w)^2 [b(2d - f) + fd]}{(b + d)(b + f)^2} \right]^{\frac{1}{2}}}$$

Since  $a > p_w$ ;  $d > f > 0$  with a PTA; all other parameters are positive and only positive roots of T (the denominator) are of interest in this paper,

$$\frac{\partial T}{\partial f} > 0$$

This means that

$$\frac{\partial f}{\partial T} > 0$$

So, the lower the trade barriers to the rest of the world, the larger the economic size of a PTA required to maintain the initial level of welfare.

Furthermore, it has already been shown that for  $0 < f < d$

$$\frac{\partial NWE}{\partial f} = b^2 (f - d) < 0$$

Thus, for a given T, the higher the PTA size (the lower the  $f$ ), the greater the positive net welfare effect of a PTA.

This implies that the lower the trade barriers (the lower the welfare attributed to a PTA), the larger the market size required not only to maintain, but to increase the original level of welfare as well.

Q.E.D.

## V. SIMULATIONS

In order to understand the results obtained, a simulation may help. To do so, values consistent with the theory -that do not allow the market to collapse or trade to disappear- are given to the parameters of the model. An example of such simulation is:

$$P_w = 20$$

$$a = 60$$

$$b = 1$$

$$c = P_w$$

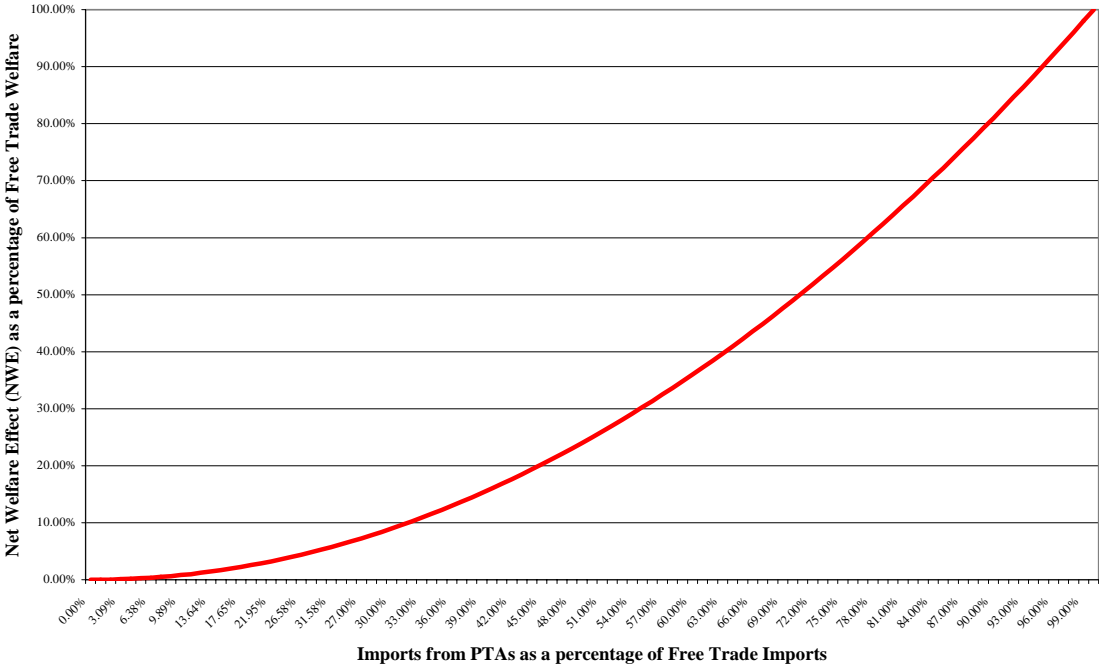
$$d = 1$$

$$e = P_w$$

In order to account for different market sizes of a PTA,  $f$  is given different values between zero and  $d$  (which is given a value of one in the simulation carried out).

With these parameters, the net welfare effects of the size of a PTA can be shown as follows. Figure 4 represents the case where trade barriers are 100% and yield autarky. In this case, preferential trade agreements are welfare improving regardless of the trade potential of a PTA, since there is only trade creation and no trade diversion at all.

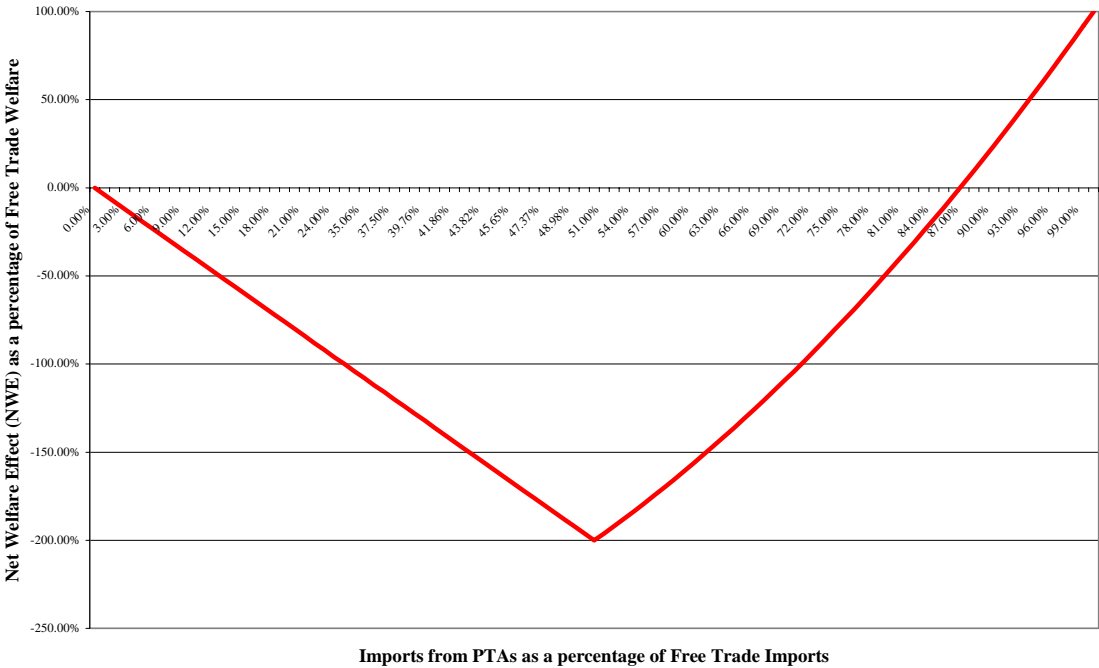
**FIGURE 4**  
**NET WELFARE EFFECTS OF DIFFERENT SIZES OF PTAs**  
**FOR A COUNTRY WITH PROHIBITIVE TRADE BARRIERS (100%)**  
**TO NON-MEMBER NATIONS**





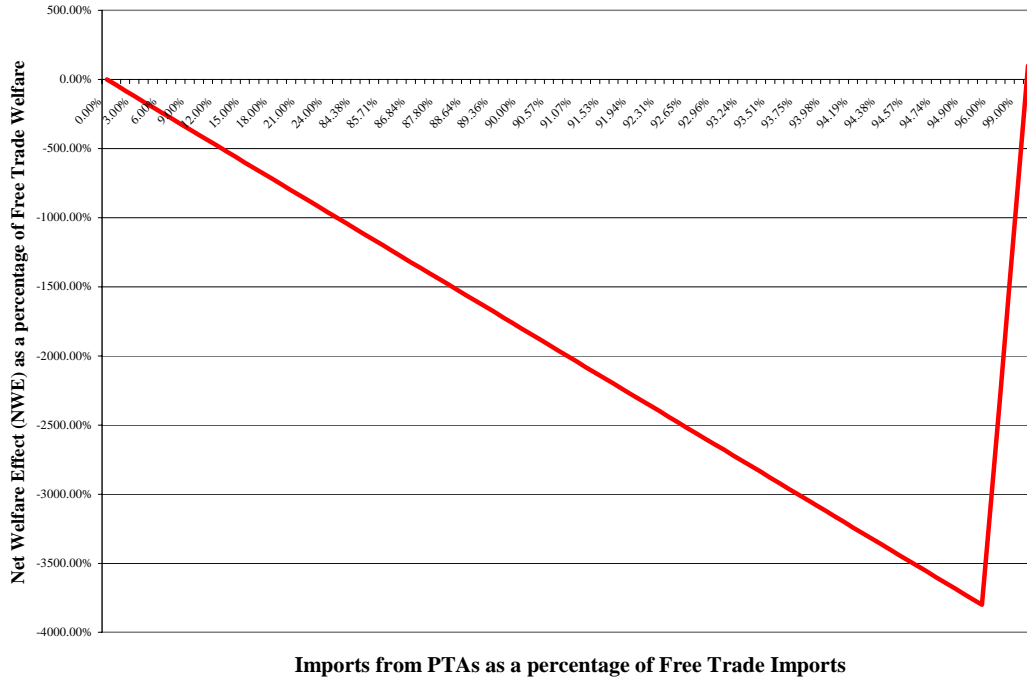
If the trade barrier levels are 50%, then if the trade potential of PTAs signed represents 50% of total potential trade, welfare is minimized. In order for PTAs to be welfare improving, trade potential of the PTAs signed must be greater or equal to 87%, as shown in figure 5.

**FIGURE 5**  
**NET WELFARE EFFECTS OF DIFFERENT SIZES OF PTAs**  
**FOR A COUNTRY WITH INTERMEDIATE TRADE BARRIERS (50%)**  
**TO NON-MEMBER NATIONS**



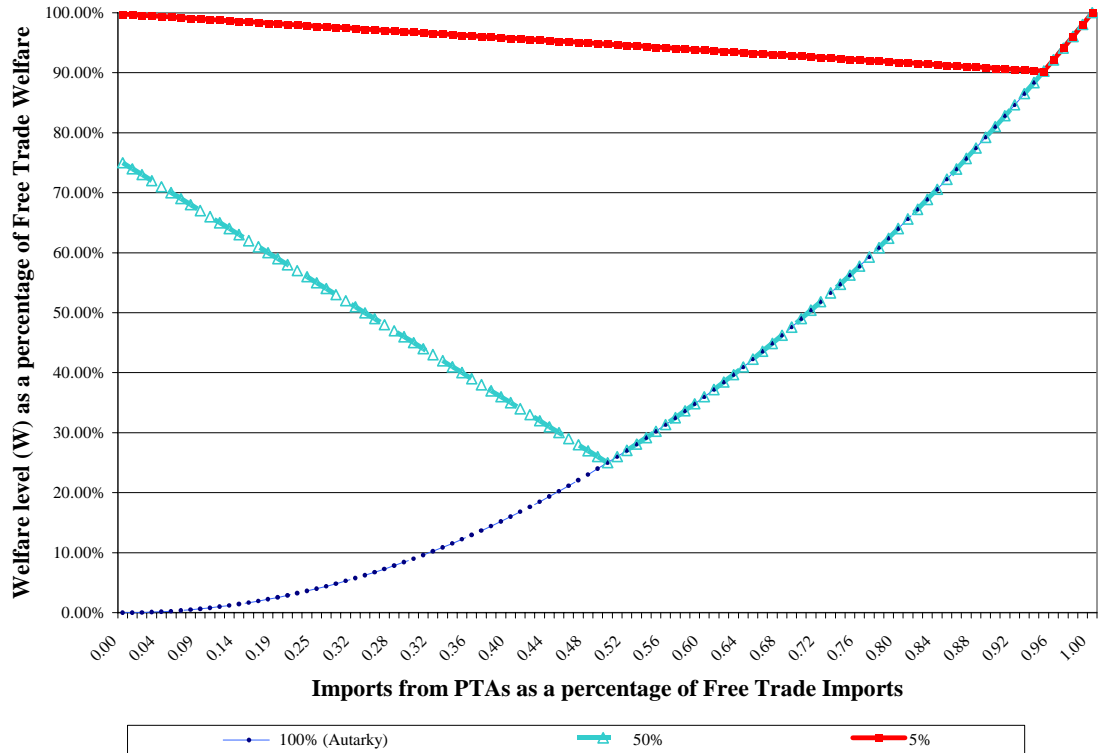
If trade protection is equivalent to 5% trade barrier rates, then welfare decreases with PTAs as long as the trade potential of PTAs is lower than 99% of total potential trade, and is minimized if trade protection is 95%, as shown in figure 6.

**FIGURE 6**  
**NET WELFARE EFFECTS OF DIFFERENT SIZES OF PTAs**  
**FOR A COUNTRY WITH LOW TRADE BARRIERS (5%)**  
**TO NON-MEMBER NATIONS**



If welfare is measured as a percentage of free trade welfare, the three scenarios described above can be grouped in one graph as shown in figure 7.

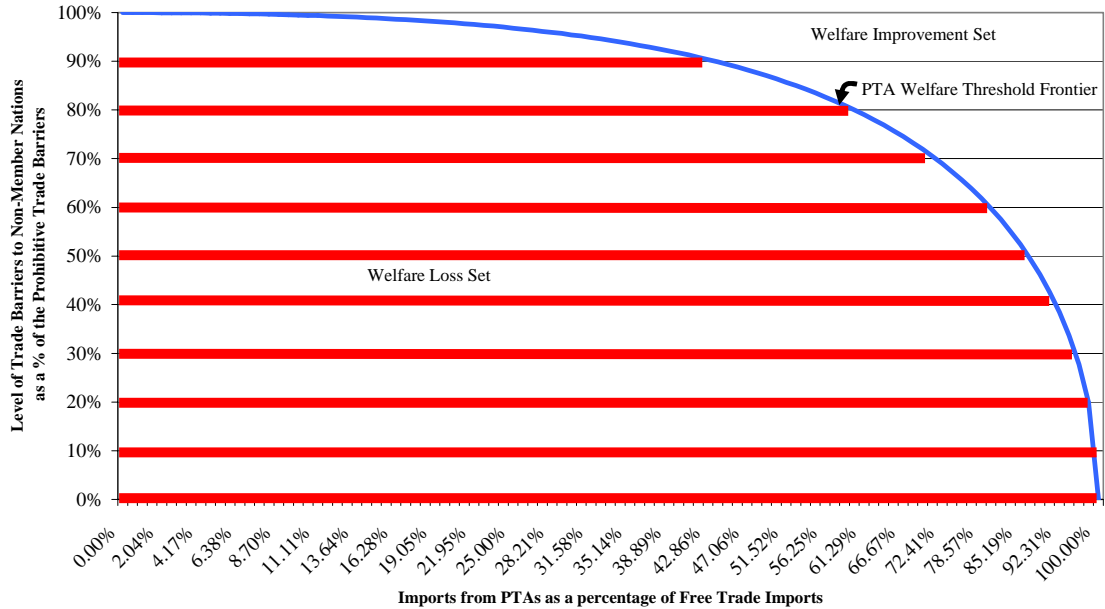
FIGURE 7  
**WELFARE LEVELS WITH DIFFERENT SIZES OF PTAs  
AND DIFFERENT LEVELS OF TRADE BARRIERS  
TO NON MEMBER COUNTRIES**



Note that in all cases, and according to the *Non-Decreasing Welfare Theorem* and the *Free Trade Corollary*, welfare is maximized with overall free trade, and that welfare is non-decreasing as trade barriers fall.

Given that the *WTF* occurs only in phase 2 and using equation (9) with the parameters of the simulation, the *WTF* can be graphed as shown in figure 8.

FIGURE 8  
**THE PTA WELFARE THRESHOLD FRONTIER**  
**( $b = 1$ ;  $d = 1$ )**



Note that when countries are in autarky, any size of PTA will improve welfare. But as countries have lower trade barriers, they require much larger PTAs in order to achieve a welfare improvement, just as stated in the *PTA Enlargement Theorem*. When reading this graph, it is important to keep in mind that countries that belong to a PTA and have lower trade barriers to non-member nations, have a higher level of welfare *ceteris paribus*. Note also that the combinations of trade barriers and market size that yield a welfare gain are represented by the Welfare Improvement Set, while the combinations that yield a welfare reduction are represented by the Welfare Loss Set.

Note as well that trade barriers are presented as a percentage of prohibitive trade barriers. Thus, the *WTF* shown in figure 8 is independent of  $p_W$  and  $a$  since:

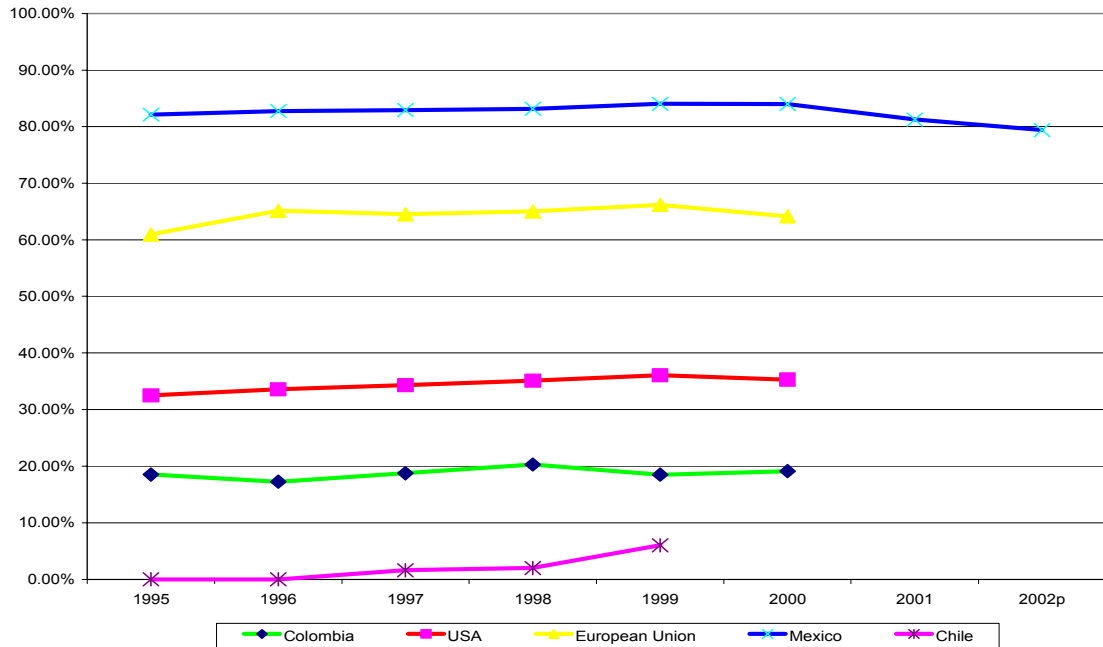
$$\frac{T}{T_{PR}} = \frac{\sqrt{f(b+d) \left[ 2bd + f(d-b) \right]}}{d(b+f)}$$

Given that *ad-hoc* intermediate parameters ( $b = 1$ ;  $d = 1$ ) have been used in the simulation presented, extreme values of the parameters have been applied to the model to determine if such extreme values of those parameters may affect the results obtained in a significant way. These simulations are shown in Appendix I, and confirm that all the theorems presented in this paper are robust to changes in parameter values, as long as those parameters remain positive and the markets under integration do not collapse, as expected from the algebra. These additional simulations also suggest that the welfare improvement set of combinations of trade barriers and the size of PTAs is quite restrictive, regardless of the parameter combinations used.

## VI. OBSERVED BEHAVIOR

The previous model and simulations are based on partial equilibrium analysis. In order to provide an idea of how countries behave in the real world, figure 9 presents the share of total trade that has flowed under formal preferential trade agreements for selected countries. The underlying assumptions are that observed trade is a good proxy for expected trade as predicted for example, by a gravity model, and that aggregate trade provides an idea of the general behaviour of the different markets in an economy.

**FIGURE 9**  
**OBSERVED TRADE COVERED BY PREFERENTIAL TRADE AGREEMENTS**  
**AS A PERCENTAGE OF TOTAL OBSERVED TRADE<sup>10</sup>.**



From the figure above it is possible to see that countries that have followed the preferential trade agreement strategy may have some way to go before they reach the potential gains from freer trade. Among the nations considered, Mexico is the most advanced country in that route, followed by the European Union, the United States, Colombia and Chile. But if recent agreements made are taken into consideration, as in figure A2-1 of appendix II, Mexico is close to 90%, and Chile follows closely the European Union with around 60% of its observed trade flowing under PTAs. However, the European Union has taken a longer time than all the other countries to reach the level of PTA trade that it has today.

<sup>10</sup> Calculations made using flows of trade covered by PTAs that were approved and effective on each year considered. Data obtained from IMF (2001), Intal (2003) and Secretaría de Economía de Mexico (2003). The agreements are listed in appendix I.

## VII. CONCLUSIONS

The model developed in this paper demonstrates that within the Viner-Lipsey framework:

- Welfare is non-linear in the trade potential of PTAs. As the size of PTAs becomes larger, welfare falls initially and a threshold size must be reached before welfare actually increases.
- *Ceteris paribus*, for whatever the size of preferential trade agreements, if trade barriers with the rest of the world are lowered, welfare is non-decreasing.
- The threshold level of a PTA's trade potential becomes larger, the lower the trade barriers that a country has with non-member nations.
- From a trade creation - trade diversion point of view, free trade maximizes world welfare, *ceteris paribus*. Multilateral trade liberalization in which all countries eliminate their trade barriers would be a first best policy<sup>11</sup>.

Some policy implications of this paper are that:

- If small countries decide to follow the PTA approach to trade liberalization, they must apply it with care, clear objectives and national commitment, since the first stages of such an approach may be welfare reducing, particularly if countries focus on deepening their existing agreements rather than enlarging them until free trade is achieved.
- Observed behaviour by selected countries using preferential trade agreements shows that several of those countries may have some way to go in their trade liberalization, and that such an approach may leave them in the welfare reducing range of preferential trade agreements. In this sense,

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<sup>11</sup> However, such approach depends critically on the will of the United States and the European Union, and such will has been questioned since GATT began. Thus, it is not surprising that smaller countries such

countries considering the PTA route towards trade liberalization, should follow Mexico rather than the European Union, and remain focused until free trade is achieved.

Some research questions derived from this paper include that:

- Given that this paper is based on the standard Viner-Lipsey perfectly competitive partial equilibrium model, it would be interesting to verify if the economic intuition developed here holds in a fully blown general equilibrium framework; with imperfectly competitive sectors and considering dynamic effects.
- Since the exercise carried out in this paper is theoretical, it would also be convenient to test empirically to what extent the results obtained should also be a reason for concern in the practice of commercial policy.

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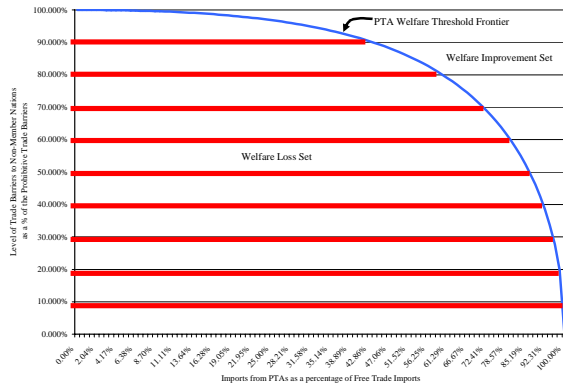
as Mexico and Chile have followed the alternative PTA route, that opens their own markets, and gives them free access to the markets of their trade partners as well.



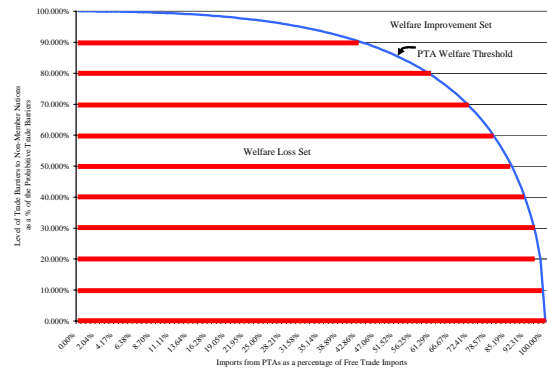
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# APPENDIX I

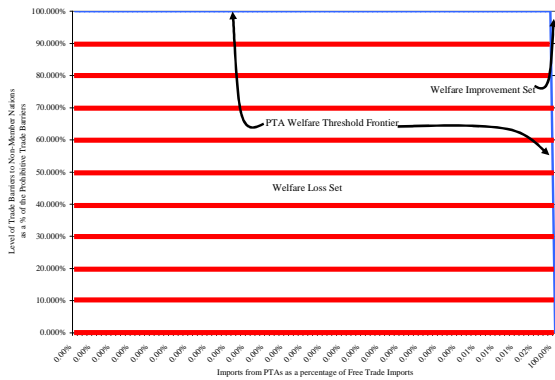
**Elastic Domestic Demand  
Elastic Domestic Supply  
( $b = 0.01$ ;  $d = 0.01$ )**



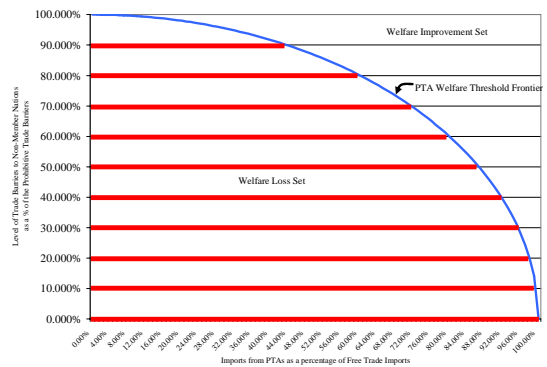
**Inelastic Domestic Demand  
Inelastic Domestic Supply  
( $b = 1000$ ;  $d = 1000$ )**



**Elastic Domestic Demand  
Inelastic Domestic Supply  
( $b = 0.01$ ;  $d = 1000$ )**



**Inelastic Domestic Demand  
Elastic Domestic Supply  
( $b = 1000$ ;  $d = 0.01$ )**



APPENDIX II  
**FORMAL FREE TRADE AGREEMENTS  
FOR SELECTED COUNTRIES OR GROUPS OF COUNTRIES.**

- Chile
  - Signed
    - Canadá 1997
    - Costa Rica 1999
    - El Salvador 1999
    - South Korea 2003
    - European Union 2003
    - EFTA 2003
    - United States 2003
    - Mexico 1999
    - Canadá 1997
  - Under negotiation:
    - Honduras
    - Guatemala
    - Nicaragua
    - ALCA 2005
    - Bolivia

Source: [http://www.direcon.cl/frame/acuerdos\\_internacionales/f\\_acuerdos.html](http://www.direcon.cl/frame/acuerdos_internacionales/f_acuerdos.html))

- Colombia<sup>12</sup>
  - Signed.

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<sup>12</sup> Colombia has a signed agreement with Caricom, but it does not operate as a proper free trade agreement. Thus, that agreement was excluded.

CAN 1992

G3 1995

Chile 1998

-Under Negotiation:

ALCA 2005

Source: [www.mincomex.gov.co](http://www.mincomex.gov.co)

- European Union

- Signed.

Chile 2003

EFTA 1994

Mexico 2003 (Liberalización total hasta 2007 para México)

Source: [www.efta.org](http://www.efta.org); <http://europa.eu.int/>; Direction of Trade Statistics (IMF))

- Mexico

- Signed.

NAFTA 1994

Bolivia 1995

G3 1995

Chile 1999

Costa Rica 1994

El Salvador 2000

Guatemala 2000

Honduras 2000

Nicaragua 1997

Israel 2000

European Union 2003

- Under negotiation:

ALCA 2005

Source: <http://www.economia-snci.gob.mx/Negociacion/negociacion.htm>)

• USA

- Signed.

Nafta 1994

Chile 2002

Israel 1985

Jordania 2001

Singapur 2003

- Under negotiation:

ALCA 2005

Australia

Cafta

Marruecos

Source: <http://www.sice.oas.org/TRADES.ASP>

**FIGURE A-1**  
**OBSERVED TRADE COVERED BY PREFERENTIAL TRADE AGREEMENTS**  
**SIGNED BY 2003, AS A PERCENTAGE OF TOTAL OBSERVED TRADE**

