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Abstract

This paper investigates the impact of free-trade areas (FTAs) on the use of contingent protection between competing exporters. We develop a dynamic model similar to the competing-importers one of Tabakis (2015), in which countries are limited to self-enforcing cooperative multilateral trade agreements and the economic environment is characterized by trade-flow volatility. Our analysis demonstrates that the findings of Tabakis (2015) extend to our competing-exporters case. In particular, the parallel formation of different FTAs results in a gradual but permanent easing of multilateral trade tensions, especially as far as contingent protection is concerned. Thus, our results highlight a building-block effect of FTAs on multilateral trade cooperation.

1 Introduction

There is an ongoing theoretical debate among economists about the impact of RTAs on the realization of multilateral trade liberalization. The first group of economists argues that RTAs can be a building block towards multilateral trade liberalization. While others argue RTAs ar a stumbling block for multilateral cooperation.

For example, Summers et al. (1991) emphasizes the positive role of RTAs on the facilitation of multilateral trade negotiations. Similarly, Ornelas (2012) by using an oligopolistic-political-economy model highlights the role played by FTAs in reducing obstacles to multilateral trade liberalization, thus emerging as a building block towards global free trade.

On the other hand, there is a theoretical justification where RTAs can be a stumbling block for multilateral negotiations due to the possibility that such agreements can generate static welfare gains. Under such circumstances, RTAs will reduce the incentives to extend trade liberalization. In his ”dynamic path model” Krugman (1993), shows how regionalism affects multilateralism.

The other theoretical paper by Krishna (1998) shows that RTAs create disincentives for multilateral trade liberalization. Using a model of imperfect competition in different segmented markets, Krishna posits two conclusions: RTAs that result in trade diversion are more likely to be supported politically and hence, such RTAs will reduce incentives for multilateral liberalization. Aghion, Antràs, and Helpman (2007) developed a dynamic bargaining model and show the possibilities of stumbling block and building blocks effects of Free Trade Areas (FTAs) on Multilateral cooperation.[1]

Bagwell and Staiger (1997) model the implication of customs union formation on multilateral tariff cooperation and shows that the early formation of customs unions can lead to a temporary easing of multilateral trade tensions at the

[1] see Bhagwati (1993) for further elaboration in this issues.

early stages of their formation. But once the process of customs unions is completed, the market–power effect becomes real and there will be an incentive to deviate to a higher tariff. The intuition is that the formation of customs unions gives rise to trade–diversion effect and a market power effect. Thus, their model shows the importance of the market power effect relative to the trade diversion effect that ultimately results in the prediction that the positive impact of custom union formation is just temporary which will have a negative consequence on multilateral tariff cooperation once the process of custom union formation is completed.

In a similar work Bagwell and Staiger (1997) model the consequence of the formation of RTAs on the ability to maintain effective multilateral cooperation. Their model predicts that from the start to the negotiation of the RTAs, the impact on the ability of multilateral cooperation is negative. However, their model suggests that the negative impact on multilateral tariff cooperation is temporary. Once RTA formation process is completed, country's ability to multilaterally cooperate is restored.

2 The Model

We assume four-country, four-good world where each importing country has three countries competing to export a specific good. Suppose the four countries are X, Y,W and Z, and the associated goods that are produced and exchanged in the international market are x, y, w and z. At any period, country i's endowment of good i and j are 1-e and $1 + \frac{e}{3}$ respectively, where j and i $\in (x, y, w, z), i \neq j$, and the variable e, which we use to capture trade-flow volatility is a random number which is drawn independently from a uniform distribution on [0,1]. Country I is the only importer of good i for $I \in (X, Y, W, Z)$. On the consumption side, we assume all countries face symmetric demand functions where the demand for product i in country J, where $J \in (X, Y, W, Z)$, is given by $C(P_i^j) = \alpha - \beta P_i^j$, where the constant β is positive, $\alpha > \frac{4}{3}$, P_i^J is the price of good i in country J. Our model follows from Tabakis (2015) which uses the competing importers model instead.

As in Tabakis (2015), in this model we assume there exists two trading blocs; country X and Y form an FTA on one side and W and Z form another FTA. Country i imports good i from country j, hence country i's import of good i from j is equal to country j' s export of good i. Thus, country i's import demand for good i from country j is given by $(1 + \frac{e}{3}) - C(P_i^j)$, which is exactly country j's export of good i. And we keep assuming each country's economic environment is characterized by the volatility of trade flows at every period that is a function of e as in Tabakis (2015).

Finally, following Tabakis (2015) and Bagwell and Staiger (1997), we assume the world goes through three phases: Phase I with no FTAs between countries, but with possibility of future FTAs negotiation between prospective country pairs; Phase II where trade negotiations are held between X and Y in the one hand,and W and Z in the other hand; finally phase III, where two symmetric FTAs are in place in the world. Moreover, each country follows the MFN principle for non-discrimination. In addition, we assume also that if FTA negotiations have not yet started, there is the possibility that the FTA negotiations between X and Y on the one hand and W and Z i in the other hand will start in next period with probability $\rho \in [0, 1]$. Finally, we assume that if the trade talks have started at time t between country pairs, they will be concluded and be in effect at t+1 with probability $\lambda \in [0, 1]$.

3 Phase III

In Phase III, X and Y form one FTA, while W and Z form another one. Thus, our analysis begins with such a symmetric world.

3.1 Phase–III static game

The non-arbitrage condition yields for good x (similarly for the rest of the good):

$$P_x^X = P_x^Y = P_x^W + \tau^X = P_x^Z + \tau^X \tag{1}$$

P_x^X refers to the price of product x in country X and τ^X and τ^W is the import tariff of country X. The market clearing price for good i requires the world demand to be equal to the world supply.

$$\begin{aligned} 1 - e + 3(1 + \frac{e}{3}) &= C_X^X + C_X^Y + C_X^W + C_X^Z \\ &= 4\alpha - 4\beta P_X^X + \beta\left(\tau^X + \tau^X\right) \end{aligned}$$

$$P_X^X = \frac{4\alpha - 4 + 2\beta\tau^X}{4\beta} = \frac{\alpha - 1}{\beta} + \frac{\tau^X}{2} = P_X^Y \tag{2}$$

Therefore:

$$P_X^W = \frac{\alpha - 1}{\beta} - \frac{\tau^X}{2} \tag{3}$$

In our case country X imports good x from three countries: Y, W and Z. But the tariff against country Y is zero due to the FTA. We assume that the tariff that is chosen by each country is non-negative and non-prohibitive. Thus, the price set for a give product has the following arbitrage condition.

Country X's import function is thus expressed as:

$$M_W^X = (1 + \frac{e}{3}) - (\alpha - \beta\left(P_X^W\right)) = \frac{e}{3} - \frac{\beta\tau^X}{2} \tag{4}$$

A similar relationship holds for X's import function from Z.

Therefore, country X's welfare is defined as the sum of the surplus received from the consumption of four goods, the surplus received from the production of the four goods and the tariff revenue from imports of X from country W and Z:

$$W_3^X = \int_{P_X^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Y^X}^{\alpha/\beta} C(P)\,dP + \int_{P_W^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Z^X}^{\alpha/\beta} C(P)\,dP$$
$$+ \int_0^{P_X^X} (1-e)\,dP + \int_0^{P_Y^X} \left(1+\frac{e}{3}\right) dP + \int_0^{P_W^X} \left(1+\frac{e}{3}\right) dP + \int_0^{P_Z^X} \left(1+\frac{e}{3}\right) dP$$
$$+\tau^X M_W^X + \tau^X M_Z^X \tag{5}$$

Using equation (5), we can derive the optimal tariff for country X:

$$\frac{\partial W_3^X}{\partial \tau^X} = \frac{e}{6} - \frac{7}{4}\beta\tau^X \tag{6}$$

This implies that W_3^X is strictly concave in τ^X and the best response tariff for X equal:

$$\tau_X^N = \frac{2e}{21\beta} \tag{7}$$

Since country X and country Y face similar situation they have the same Nash tariff. That is the Nash tariff for country Y equal:

$$\tau_Y^N = \frac{2e}{21\beta} \tag{8}$$

Note that the global efficient tariff is zero since $\frac{\partial W_3(e,\vec{\tau})}{\partial \tau} = -2\beta\tau$ implying that the Nash tariff choosen by each country is not efficient. Hence countries can become better off if they cooperatively choose their tariffs. To give an intuitive explanation, a tariff by a given country worsens the exporting countries' terms of trade and hence welfare. Though the importing country is better off in terms of generating tariff revenue, its welfare will be negatively affected by the tariffs it faces against its exports. The implication is that our static game features of the Prisoners dilemma property. Hence, countries can do better if they cooperate.

3.2 Phase–III dynamic game

Now we consider a dynamic where countries engage in a repetition of the static game analysed above. We assume at the start of the period, countries are informed about the current trade shock and its implications for inter-bloc trade volume. Then they simultaneously choose their current period tariff. When countries choose their current period tariff, the chosen tariff must be self-enforcing. More precisely, for a given value of e, a one-time deviation from the cooperative tariff must not exceed the discounted future benefit of cooperation. To develop it mathematically gain from one time deviation given by:

$$\Omega_3(\tau_x^N, \tau_x^c, \tau_{-x}^c) \equiv W_3^X(\tau_x^N, \tau_{-x}^c) - W_3^X(\tau_x^c, \tau_{-x}^c) \tag{9}$$

$$\begin{aligned} \frac{d\Omega_3(e, \tau_x^N, \tau_x^c, \tau_{-x}^c)}{de} = \frac{\partial W_3^x(e, \tau_x^N, \tau_x^c, \tau_{-x}^c)}{\partial e} - \frac{\partial W_3^x(e, \tau_x^c, \tau_x^c, \tau_{-x}^c)}{\partial e} \\ = \frac{1}{6}[\tau_x^N - \tau_x^c] \end{aligned} \tag{10}$$

$$\begin{aligned} \frac{d\Omega_3(e, \tau_x^N, \tau_x^C, \tau_{-x}^c)}{d\tau_x^c} = \frac{\partial W_3^x(e, \tau_x^N, \tau_x^c, \tau_{-x}^c)}{\partial \tau_{-x}^c} - \frac{\partial W_3^x(e, \tau_x^c, \tau_x^c, \tau_x^c)}{\partial \tau_x^c} \\ = -[\frac{1}{6}\tau_x^N - \frac{7\beta}{4}\tau_x^c] \end{aligned} \tag{11}$$

Using the Envelope theorem, $\frac{d\Omega_3(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{de} > 0$ and $\frac{d\Omega_3(e,\tau_x^N,\tau_x^c,\tau_{-x}^c)}{d\tau_x^c} < 0$ if and only if $\tau_x^C < \frac{2e}{21\beta} = \tau_x^N$. In other words, if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat. In general the static gain from defection is given by :

$$\Omega_3(\tau_x^N, \tau_x^c, \tau_{-x}^c) = \frac{7b}{8}[(\tau_x^c)^2 - (\tau_x^N)^2] + \frac{e}{6}[\tau_x^N - \tau_x^c] \tag{12}$$

However, any temptation to cheat has the risk of future trade war due to grim-trigger strategy employed by all countries. Thus, when countries attempt to deviate from the cooperative tariff, they compare the static gain from defection with the future discounted value of cooperation. Suppose all countries value the future equally and let each country's discount factor between periods be $\delta \in [0, 1)$ and E be the expectations operator with expectations taken over the distribution of e. Then the present discounted value of the expected future gains from multilateral cooperation today is given as:

$$\frac{\delta}{1-\delta}[EW^x(e, \tau_x^C, \tau_{-x}^C) - EW^x(e, \tau_x^N, \tau_{-x}^N)]$$
$$\equiv \omega_3(\tau_3^c(.)) \tag{13}$$

Thus, from the equation (9) and (13), the countries no defect condition at the phase–III is given by:

$$\Omega_3(e, \tau_x^c(e), \tau_x^c(e, \tau_y^c(e), \tau_z^c(e) \leq \omega_3(e, \tau_x^c(e), \tau_x^c(e, \tau_w^c(e), \tau_z^c(e)), \forall e \tag{14}$$

But on equation (13) illustrates ω_3 itself depends on the cooperative tariff function selected by countries. Therefore we need to make sure that equation (13) and (14) are consistent. To do this our interest lies on finding the most cooperative tariff function chosen by the four countries. Hence, we the approach of Tabakis (2015) and Bagwell and Staiger (1988), we initially fix ω_3 at an arbitrary non-negative value ,$\bar{\omega_3}$, and solve the smallest possible non negative cooperative tariff (τ_3^c) as well as the threshold volume of trade($\bar{e_3}$).

Thus, fixing $\bar{\omega_3} > 0$ and solving for $\bar{e}_3$:

$$\omega \equiv W^X(\bar{e_1}, \tau_X^N(\bar{e}), 0) - W^X(\bar{e}, 0, 0) = \frac{e^2}{126\beta}$$

$$\bar{e_1} = \sqrt{126\beta\omega} \tag{15}$$

The value on equation (15)is the threshold volume of trade where free trade trade can maintained. Thus, the most cooperative tariff for country X can be found by solving the following equation :

$$\omega = W^X\left(e, \tau_X^N, \tau_{-x}^c\right) \; - \; W^X\left(e, \tau_x^c, \tau_{-x}^c\right) \tag{16}$$

Solving for τ_X^c,

$$\tau_x^c = \frac{2\left[e - \sqrt{126\beta\omega}\right]}{21\beta} = \frac{2\left[e - \bar{e}\right]}{21\beta} \tag{17}$$

Putting all together, we can summarize our findings in Lemma 1 .

Lemma 1:

$$F\left(y\right) = 2y^{\frac{3}{2}} - 6y + 6y^{\frac{1}{2}} \tag{18}$$

$$\hat{\tau_x^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e_3}]; \\ \frac{2(e-\bar{e})}{21\beta} & \text{if } e \in \; (\bar{e}_3, 1]. \end{cases} \tag{19}$$

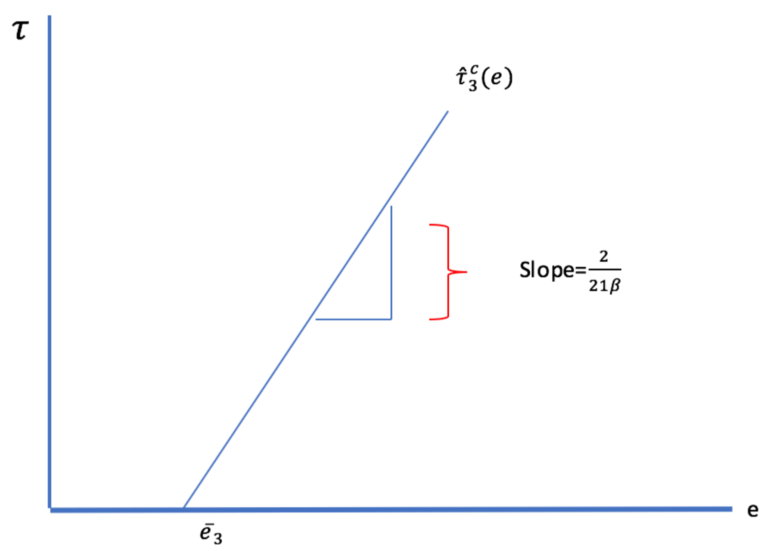
Where: $\bar{e}_3 = \sqrt{126\beta\omega^{III}}$

and with $\omega^{III} \in (0, \frac{1}{126\beta})$ being the unique interior fixed point of:

$$\widetilde{\omega}^{III}(\bar{\omega_3}) = \begin{cases} \frac{\delta}{1-\delta}\frac{F(126\beta\bar{\omega})}{1323\beta} & \text{if } \bar{\omega}_3 \in [0, \frac{1}{126\beta}]; \\ \frac{\delta}{1-\delta}\frac{2}{1323\beta} & \text{if } \bar{\omega}_3 > \frac{1}{126\beta}. \end{cases} \tag{20}$$

The implication of lemma 1 is that free trade can be sustained between countries if the inter-bloc trade volume is low. For low inter-bloc volume of trade, the incentive to defect is small. But as along as the trade volume between blocs increases and sufficiently greater than the threshold volume of trade, $\bar{e}_3$, there will be greater incentive to deviate from multilateral cooperation and hence, free trade couldn't be an option. As a result, countries may apply special protection such as safeguards or countervailing duties so that the incentive to deviate from the cooperative tariff would is kept check. Figure 1 depicts the most cooperative tariff as a function of volume of trade, e.

Figure 1: Tariff function in Phase III



4 Phase II

Phase II is the transition period where there are two parallel trade talks between the country pairs.

4.1 Phase–II static game

In phase II, we can characterize the Nash equilibrium by looking at country X , due to the fact that all countries face a symmetric situation. Hence, the market–

clearing price for good X is detrmined where by having that world supply equals world demand for good x.

$$P_x^x = \frac{\alpha - 1}{\beta} + \frac{3\tau^x}{4} \tag{21}$$

$$P_x^{-x} = \frac{\alpha - 1}{\beta} - \frac{\tau^x}{4} \tag{22}$$

Country X's imports from J, where $J \in (Y, W, Z)$ are equal to country J's total export of good X. Thus, imports are given by:

$$M_j^x = (1 + \frac{e}{3}) - (\alpha - \beta P_x^j) = \frac{e}{3} - \frac{\beta\tau^x}{4} \tag{23}$$

Now define the welfare of X as the sum of consumer surplus, Producer surplus and tariff revenue.

$$\begin{aligned} W_2^X = &\int_{P_X^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Y^X}^{\alpha/\beta} C(P)\,dP + \int_{P_W^X}^{\alpha/\beta} C(P)\,dP + \int_{P_Z^X}^{\alpha/\beta} C(P)\,dP \\ &+ \int_0^{P_X^X} (1-e)\,dP + \int_0^{P_Y^X} \left(1 + \frac{e}{3}\right) dP + \int_0^{P_W^X} \left(1 + \frac{e}{3}\right) dP + \int_0^{P_Z^X} \left(1 + \frac{e}{3}\right) dP \\ &\tau^X M_Y^X + \tau^X M_W^X + \tau^X M_Z^X. \end{aligned} \tag{24}$$

Using equation (24), we can derive the optimal tariff for country X:

$$\frac{\partial W_2^X}{\partial \tau^X} = \frac{e}{4} - \frac{15}{16}\beta\tau^X \tag{25}$$

This implies that W_2^X is strictly concave in τ^X and the Nash tariff for X equal:

$$\tau_X^N = \frac{4e}{15\beta} \tag{26}$$

Note that the Nash tariff in phase III is less than the phase–II Nash tariff of $\frac{4e}{15\beta}$ implying that once, FTAs are formed between countries, each country reduces the external tariffs against non-members. This is of course inline with past literature about the existence of tariff complementarity effect.

4.2 Phase–II dynamic game

Now we turn to characterize the phase II dynamic game: Doing so, we first look at the most cooperative tariff function that can be supported during the time where trade negotiation is underway which we call it the transition phase. The most cooperative tariff that is self-enforcing is relative to the static gain from defecting from cooperative tariff.

The static gain from defection is given by :

$$\begin{aligned}\Omega_2(\tau_x^N, \tau_x^C, \tau_{-x}^C) &= W_2^x(\tau_x^N, \tau_{-x}^C) - W_2^x(\tau_x^C, \tau_{-x}^C)\\ &= \frac{15\beta}{32}[(\tau_x^C)^2 - (\tau_x^N)^2] + \frac{e}{4}[\tau_x^N - \tau_x^C]\end{aligned} \tag{27}$$

Thus;

$$\frac{d\Omega_2(e, \tau_x^N, \tau_x^C, \tau_{-x}^c)}{de} = \frac{\partial W_2^x(e, \tau_x^N, \tau_x^C, \tau_{-x}^c)}{\partial e} - \frac{\partial W_2^x(e, \tau_x^c, \tau_x^C, \tau_{-x}^c)}{\partial e} = \frac{1}{4}[\tau_x^N - \tau_x^c] \tag{28}$$

$$\frac{d\Omega_2(e, \tau_x^N, \tau_x^c, \tau_{-x}^c)}{d\tau_x^c} = \frac{\partial W_2^x(e, \tau_x^N, \tau_x^C, \tau_{-x}^C)}{\partial \tau_{-x}^c} - \frac{\partial W_2^x(e, \tau_x^c, \tau_x^C, \tau_x^C)}{\partial \tau_x^C} = -[\frac{1}{4}\tau_x^N - \frac{7\beta}{4}\tau_x^c] \tag{29}$$

Using the envelope theorem, $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{de} > 0$ and $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{d\tau_x^C} < 0$, which is true if and only if $\tau_x^C < \frac{4e}{15\beta} = \tau_x^N$. In other words if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat.

The discounted expected future welfare loss for a country that violates multilateral cooperation today is given by:

$$\omega_2 = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}[EW_2(e,\tau_x^c,\tau_{-x}^c) - EW_2(e,\tau_x^N,\tau_{-x}^N)] + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III}$$
$$\omega_2 = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\left[\frac{2}{75\beta}\left(var\left(e\right)+\left(E\left(e\right)\right)^2\right) - \frac{3\beta}{8}\left(var\left(\tau^c\right)+\left(E\left(\tau^c\right)\right)^2\right)\right] + \frac{\lambda\omega^{III}}{1-(1-\lambda)} \tag{30}$$

We first fix ω_2 at an arbitrary non-negative value and solve for the smallest possible non negative cooperative tariff as well as the threshold volume of trade. Thus, the most cooperative function is given by:

$$\hat{\tau_x^c}(e) = \begin{cases} 0 & \text{if } e \in [0,\bar{e}_2]; \\ \frac{4(e-\bar{e}_2)}{15\beta} & \text{if } e \in \ (\bar{e}_2, 1]. \end{cases} \tag{31}$$

We have that:

$$\widetilde{\omega}^{II}(\omega^{II}) = \frac{(1-\lambda)\,\delta}{1-(1-\lambda)\,\delta}\left[\frac{\left[2\left(\sqrt{30\beta\,\omega}\right)^3 - 180\beta\omega + 6\sqrt{30\beta\omega}\right]}{225\beta}\right] + \frac{\lambda}{1-(1-\lambda)\,\delta}\omega^{III} \tag{32}$$

Define a function :

$$F(y) = 2y^{\frac{3}{2}} - 6y + 6y^{\frac{1}{2}}$$

$$\widetilde{\omega}^{II}(\omega^{II}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III}$$

$$\widetilde{\omega}'^{II}(\omega^{II}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{30F\left(30\beta\omega^{II}\right)}{225\beta} > 0 \text{ iff } 30\beta\omega^{II} \neq 1 \implies \omega^{II} \neq \frac{1}{30}$$

$\widetilde{\omega}'^{II}(0) = \infty$

$\widetilde{\omega}'^{II}(\frac{1}{30\beta}) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{30F(1)}{225\beta} = 0$

$\widetilde{\omega}''^{II}(\omega) = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{900F\left(30\beta\omega^{II}\right)}{225\beta} < 0 \text{ iff } 30\beta < 1 \implies \omega^{II} < \frac{1}{30\beta}$

Therefore, the neccessary and sufficient condition for a unique fixed point $\omega^{II} \in (0, \frac{1}{30\beta})$ is $\widetilde{\omega}^{II}(\frac{1}{30\beta}) < \frac{1}{30\beta}$

Lemma 2 The proofs are discussed above:

The most cooperative tariff in Phase II is

$$\hat{\tau^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e}_2]; \\ \frac{4(e-\bar{e}_2)}{15\beta} & \text{if } e \in \ (\bar{e}_2, 1]. \end{cases} \tag{33}$$

Where $\bar{e}_2 = \sqrt{30\beta\omega^{II}}$

and

With $\omega^{II} \in (0, \frac{1}{30\beta})$ being the unique fixed point of:

$$\widetilde{\omega}^{II}(\bar{\omega}) = \begin{cases} \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F(30\beta\bar{\omega})}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} & \text{if } \bar{\omega}^{II} \in [0, \frac{1}{30\beta}]; \\ \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{2}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} & \text{if } \bar{\omega}^{II} > \frac{1}{30\beta}. \end{cases} \tag{34}$$

Having all these most cooperative tariffs, we compare ω^{II} and ω^{III}

Lemma 3: $\omega^{II} < \omega^{III}$. The proof for this is in the appendix:

The implication of Lemma 3 has the following corollary:

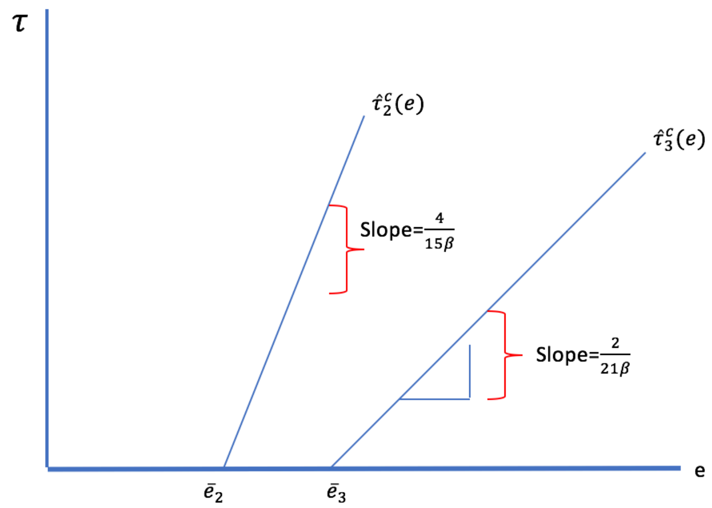
Corollary 1: $\bar{e}^{II} < \bar{e}^{III}$

Using equation (19) and (33), we have the following proposition

Proposition 1: $\hat{\tau_2^c}(e) = \hat{\tau_3^c}(e) = 0$ for $e \in [0, \bar{e_2}]$; and $\hat{\tau_2^c}(e) > \hat{\tau_3^c}(e)$ for $e \in [\bar{e_2}, 1]$.

An important observation of phase II is that, the threshold volume of inter-bloc trade where free trade can be maintained is lower in phase II than phase III implying that protection measures are more frequent and higher as compared to phase III. Figure 2, shows the phase II and III most cooperative tariffs as a function of trade volume.

Figure 2: Most cooperative tariff function in phase II and phase III



5 Phase I

Phase I is a period where countries trade normally but expect that trade negotiations will start soon between them. Here the phase I static game outcome is similar with that of phase II. Where the static Nash- tariff is :$\tau_j^N = \frac{4e}{15\beta}$ where j=X,Y,W, and Z

5.1 Phase–I dynamic game

Now we turn to analyze the most cooperative tariff that can be supported during the pre-negotiation period. We start by analyzing the static incentive to cheat from the most cooperative tariff. Welfare gain from cheating from the most cooperative tariff equal:

$$\begin{aligned}\Omega(\tau_x^N, \tau_x^C, \tau_{-x}^C) &= W^x(\tau_x^N, \tau_{-x}^C) - W^x(\tau_x^C, \tau_{-x}^C) \\ &= \frac{15\beta}{32}[(\tau_x^C)^2 - (\tau_x^N)^2] + \frac{e}{4}[\tau_x^N - \tau_x^C] \end{aligned} \tag{35}$$

$$\begin{aligned}\frac{d\Omega(e, \tau_x^N, \tau_x^C, \tau_{-x}^C)}{de} = \frac{\partial W^x(e, \tau_x^N, \tau_x^C, \tau_{-x}^C)}{\partial e} - \frac{\partial W^x(e, \tau_x^c, \tau_x^C, \tau_{-x}^C)}{\partial e} \\ = \frac{1}{4}[\tau_x^N - \tau_{-x}^C] \end{aligned} \tag{36}$$

$$\begin{aligned}\frac{\partial\Omega(e, \tau_x^N, \tau_x^C, \tau_{-x}^C)}{\partial \tau_x^C} = \frac{\partial W^x(e, \tau_x^N, \tau_x^C, \tau_{-x}^C)}{\partial \tau_{-x}^C} - \frac{\partial W^x(e, \tau_x^c, \tau_x^C, \tau_x^C)}{\partial \tau_x^C} \\ = -[\frac{1}{4}\tau_x^N - \frac{7\beta}{4}\tau_x^C] \end{aligned} \tag{37}$$

Using the envelope theorem, $\frac{d\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{de} > 0$ and $\frac{\partial\Omega(e,\tau_x^N,\tau_x^C,\tau_{-x}^C)}{\partial\tau_x^C} < 0$, which is true if and only if $\tau_x^C < \frac{4e}{15\beta} = \tau_x^N$. In other words if the cooperative tariff is set to the Nash tariff, there is no incentive to cheat.

The discounted expected future welfare loss for a country that violates the multilateral cooperation today is given by:

$$\omega_1 = \frac{(1-\rho)\,\delta}{1-(1-\rho)\,\delta}\left[EW\left(e,\,\tau_x^c,\,\tau_{-x}^c\right) - EW\left(e,\,\tau_x^N,\,\tau_{-x}^N\right)\right] + \frac{\rho}{1-(1-\rho)\,\delta}\frac{\omega^{II} - \lambda{\omega_1}^{III}}{1-\lambda} \quad (38)$$

Finally,

$$\omega_1 = \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\left[\frac{2}{75\beta}\left(var\left(e\right)+\left(E\left(e\right)\right)^2\right) - \frac{3\beta}{8}\left(var\left(\tau^c\right)+\left(E\left(\tau^c\right)\right)^2\right)\right] + \frac{\rho}{1-(1-\rho)\,\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda}$$
$$= \frac{(1-\rho)\,\delta}{1-(1-\rho)\,\delta}E\left[\frac{-225\beta^2\left(\tau_x^c\right)^2+16e^2}{600\beta}\right] + \frac{\rho}{1-(1-\rho)\,\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda}. \quad (39)$$

Lemma 4: The most Cooperative tariff function in Phase I equal:

$$\hat{\tau^c}(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e_1}]; \\ \frac{4(e-\bar{e})}{15\beta} & \text{if } e \in \ (\bar{e}, 1]. \end{cases} \quad (40)$$

Where $\bar{e}_1 = \sqrt{30\beta\omega^I}$ and

with $\omega^I \in (0, \frac{1}{30\beta})$ being the unique fixed point of:

$$\widetilde{\omega}^I(\bar{\omega}) = \begin{cases} \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\bar{\omega}^I\right)}{225\beta} + \frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\delta\omega^{III}}{1-\lambda} & \text{if } \bar{\omega}^I \in [0, \frac{1}{30\beta}]; \\ \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{2}{225\beta} + \frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\delta\omega^{III}}{1-\lambda} & \text{if } \bar{\omega}^I > \frac{1}{30\beta}. \end{cases} \quad (41)$$

Now let's compare ω^I and ω^{II}

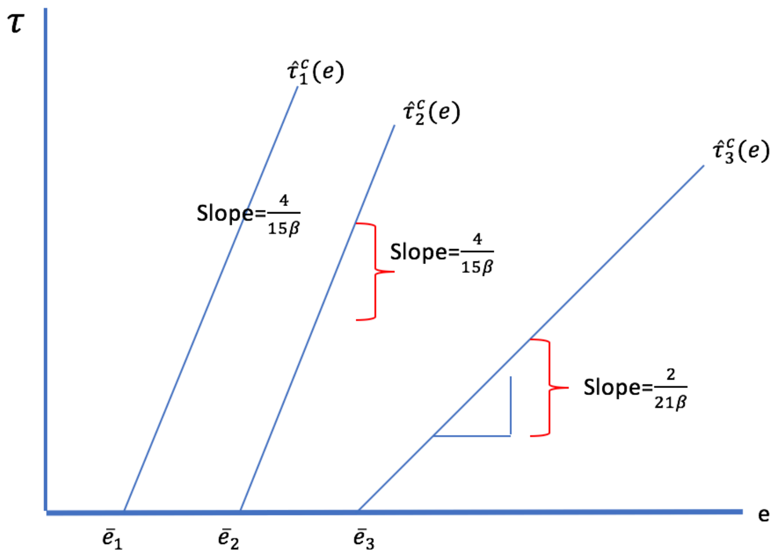
Lemma 5: $\omega^I < \omega^{II}$. From Lemma 4 and Lemma 6 implies $\omega^I < \omega^{III}$

Corollary 3: $\bar{e}^I < \bar{e}^{II} < \bar{e}^{III}$

Proposition 2: $\hat{\tau_1^c}(e) = \hat{\tau_2^c}(e) = \hat{\tau_3^c}(e) = 0$ if $e \in [0, \bar{e_1}]$ and $\hat{\tau_1^c}(e) > \hat{\tau_2^c}(e) > \hat{\tau_3^c}(e)$ if $e \in (\bar{e_1}, 1]$,

Implications: Comparing phase II and I, we find that even in the absence of FTAs , the prospects of having FTAs between countries in the future matters as soon as parallel trade talks are opened between them, the ability of countries to multilaterally cooperate is enhanced and hence, any trade tension among them starts to decline. Figure 3 summarizes the most cooperative tariff functions for all phases.

Figure 3: The most cooperative tariff functions in phase I, phase II and Phase II



6 Conclusion

This paper investigates the impact of FTAs on the use of contingent protection between competing exporters. We consider four-country, four-goods model and develop a dynamic model similar to the competing-importers one of Tabakis (2015), where multilateral trade cooperative must be self-enforcing and the economic environment is characterized by trade-flow volatility. We model three distinct but interrelated phases; phase I is the pre negotiations period, phase II negotiation period and phase III is the period where the world has two symmetric

FTAs among the four countries. Our analysis demonstrates that the findings of Tabakis (2015) extend to our competing-exporters case. In particular, the parallel formation of different FTAs results in a gradual but permanent easing of multilateral trade tensions, especially as far as contingent protection is concerned. Thus, our results supports the building-block effect of FTAs on multilateral trade cooperation.

Though our model constitutes an extension of the previous literature, we believe that our results provide further evidence that the formation of FTAs enhances multilateral cooperation. In the future, we plan to consider the asymmetric formation of FTAs in order to shed more lights on the question at hand.

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7 Appendix A

Proof of Lemma 1

Following Similar procedure as in Tabakis(2015), we have the following most cooperative tariff function.

$$\hat{\tau}_x^c(e) = \begin{cases} 0 & \text{if } e \in [0, \bar{e}_3]; \\ \frac{2(e-\bar{e})}{21\beta} & \text{if } e \in \ (\bar{e}_3, 1]. \end{cases} \quad \bar{e}_3 = \sqrt{126\beta\omega}$$

$$\omega = \tfrac{\delta}{1-\delta}\tfrac{1}{1323}\left[2\left(\sqrt{126\beta\omega}\right)^3 - 6\left(126\beta\omega\right) + 6\sqrt{126\beta\omega}\right]$$

Define a function :

$$F\left(y\right) = 2y^{\frac{3}{2}} - 6y + 6y^{\frac{1}{2}}$$

$$F'\left(y\right) = 3\left(y\right)^{\frac{1}{2}} - 6 + 3\left(y\right)^{-\frac{1}{2}} = 3\left(y^{\frac{1}{2}} + y^{-\frac{1}{2}} - 2\right) = 3\frac{\left(\sqrt{y}-1\right)^2}{\sqrt{y}} > 0 \text{ iff } y \neq 1$$

$$F''\left(y\right) = 3\frac{1}{2}\left(y\right)^{-\frac{1}{2}} - 3\frac{1}{2}\left(y\right)^{-\frac{3}{2}} = \frac{3}{2}\left(y^{-\frac{1}{2}} - y^{-\frac{3}{2}}\right) = \frac{3}{2}\left(\frac{1}{\sqrt{y}} - \frac{1}{y^{\frac{3}{2}}}\right) = \frac{3\left(x-1\right)}{2y^{\frac{3}{2}}} < 0 \text{ iff } y < 1$$

$$\widetilde{\omega}\left(\omega\right) = \frac{\delta}{1-\delta}\frac{2\left(\sqrt{126\beta\omega}\right)^3 - 6(126)\beta\omega + 6\sqrt{126\beta\omega}}{1323\beta} = \frac{\delta}{1-\delta}\frac{F\left(126\beta\omega\right)}{1323\beta}$$

$$\widetilde{\omega}\left(0\right) = \tfrac{\delta}{1-\delta}\tfrac{F(0)}{1323\beta} = 0$$

$$\widetilde{\omega}'\left(\omega\right) = \tfrac{\delta}{1-\delta}\tfrac{126}{1323}F'\left(126\beta\omega\right) > 0 \text{ iff } 126\beta\omega \neq 1 \Rightarrow \omega \neq \tfrac{1}{126\beta}$$

$$\widetilde{\omega}'\left(0\right) = \tfrac{\delta}{1-\delta}\tfrac{126}{1323}F'\left(0\right) = \tfrac{\delta}{1-\delta}\tfrac{126}{1323}3\tfrac{(0-1)^2}{0} = +\infty$$

$$\widetilde{\omega}'\left(\tfrac{1}{126\beta}\right) = \tfrac{\delta}{1-\delta}\tfrac{126}{1323}F'\left(1\right) = \tfrac{\delta}{1-\delta}\tfrac{126}{1323}3\tfrac{(1-1)^2}{1} = 0$$

$$\widetilde{\omega}_1''\left(\omega_1\right) = \tfrac{\delta}{1-\delta}\tfrac{15876\beta}{1323}F''\left(126\beta\omega\right) < 0 \text{ iff } 126\beta\omega < 1 \Rightarrow \omega_1 < \tfrac{1}{126\beta}$$

$$\{0 < \omega^{III} < \tfrac{1}{126\beta}\}$$

Then ,

$\implies \frac{\delta}{1-\delta}\frac{F(1)}{1323\beta} < \frac{1}{126\beta}$

$\implies \delta < \frac{1323}{1575} = 0.84$

Proof of Lemma 3

We define a continuous function $\phi(\bar{\omega}^{II}) = \tilde{\omega}^{II}(\bar{\omega}^{II}) - \bar{\omega}^{II}$

$\phi(0) = \frac{\lambda}{1-(1-\lambda)\delta}\omega_i^{III} > 0$ Thus if $\phi(\omega^{III}) - \omega^{III} < 0$ then we must have $\phi(\bar{\omega}^{II}) = 0$, in the interval $(0, \omega^{III}) \implies \omega^{II} < \omega^{III}$

Hence,the following should be satisfied

$\tilde{\omega}^{II}(\omega^{III}) < \omega^{III} \iff \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{III}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} < \omega^{III}$

Rearranging :

$\iff \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega_i^{III}\right)}{225\beta} < \frac{(1-\lambda)(1-\delta)}{1-(1-\lambda)\delta}\omega_i^{III}$

$\iff \delta\frac{F\left(30\beta\omega_i^{III}\right)}{225\beta} < (1-\delta)\,\omega_i^{III}$

$\iff F\left(30\beta\omega^{III}\right) < (1-\delta)\,\omega^{III}\frac{225\beta}{\delta} \implies F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$ Recall from the proof of Lemma 1 F(y) is strictly increasing for all y except $y \neq 1$:

Hence,

$\implies F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

Thus: Since $\omega^{III} < \frac{1}{126\beta} < \frac{1}{30\beta}$, F is strictly increasing

$\implies F\left(126\beta\omega^{III}\right) > F\left(30\beta\omega^{III}\right) < \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

$\implies F\left(126\beta\omega^{III}\right) > \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

From Lemma 1 we have $F\left(126\beta\omega^{III}\right) = \frac{1323\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

Therefore, $\frac{1323\beta\omega^{III}}{\frac{\delta}{1-\delta}} > \frac{225\beta\omega^{III}}{\frac{\delta}{1-\delta}}$

Proof of Lemma 5:

Using the same techniques as in the proof of Lemma 4, we define a function $\pi\left(\bar{\omega}^I\right) \equiv \tilde{\omega}^I(\bar{\omega}^I) - \bar{\omega}^I$ and recalling $\omega^I \in (0, \frac{1}{30\beta})$ if we evaluate $\phi(0) = \tilde{\omega}(0) - 0 = \frac{\rho\left(\omega^{II} - \omega^{III}\right)}{[1-(1-\rho)\delta][1-\lambda]} > 0$

And $\frac{\rho\left(\omega^{II} - \omega^{III}\right)}{[1-(1-\rho)\delta][1-\lambda]} = \frac{\rho}{[1-(1-\rho)\delta][1-\lambda]}\left[\frac{(1-\lambda)\delta}{1-(1-\lambda)}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda(\delta-\lambda\delta)}{1-(1-\lambda)\delta}\omega^{III}\right]$

Therefore if $\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0 \implies \pi(\bar{\omega}^I) = 0$ at some point $(0, \omega^I)$

Next we will check if $\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0$

$\pi(\omega^{II}) < \tilde{\omega}^I(\omega^{II}) - \omega^{II} < 0 \implies \tilde{\omega}^I(\omega^{II}) < \omega^{II}$

$\implies \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\rho}{1-(1-\rho)\delta}\frac{\omega^{II}-\lambda\omega^{III}}{1-\lambda} < \omega^{II}$

$\iff \frac{\rho}{[1-(1-\rho)\delta][1-\lambda]}\left[\frac{(1-\lambda)\delta}{1-(1-\lambda)}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda(\delta-\lambda\delta)}{1-(1-\lambda)\delta}\omega^{III}\right]\left[\frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\,\omega^{II}\right)}{225\beta}\right] + \frac{(1-\rho)\delta}{1-(1-\rho)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta}$

$< \frac{(1-\lambda)\delta}{1-(1-\lambda)\delta}\frac{F\left(30\beta\omega^{II}\right)}{225\beta} + \frac{\lambda}{1-(1-\lambda)\delta}\omega^{III} \iff \frac{\lambda\delta}{[1-(1-\rho)\delta][1-(1-\lambda)\delta]}\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta} - \frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right] < 0$

Note: The term in the bracket is negative because from Lemma 3, $\omega^{II} < \omega^{III} \implies F(30\beta\omega^{II}) < F(30\beta\omega^{III})$ Since, $\frac{\lambda\delta}{[1-(1-\rho)\delta][1-(1-\lambda)\delta]} > 0$; we need to show $\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta} - \frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right]$ is negative. Divide all terms by $\frac{\delta}{1-\delta}$

$\frac{F\left(30\beta\omega^{II}\right)}{\frac{225\beta}{\frac{\delta}{1-\delta}}} - \frac{F\left(126\beta\,\omega^{III}\right)}{\frac{1323\beta}{\frac{\delta}{1-\delta}}}$

From Lemma 1 $F\left(126\beta\,\omega^{\,III}\right)=\frac{1323\beta}{\frac{\delta}{1-\delta}}\implies\frac{F\left(126\beta\,\omega^{\,III}\right)}{\frac{1323\beta}{\frac{\delta}{1-\delta}}}=1$

From Lemma 4: $F\left(30\beta\,\omega^{\,III}\right)<\frac{225\beta}{\frac{\delta}{1-\delta}}$ and $\omega^{II}<\omega^{III}\implies F\left(30\beta\omega^{II}\right)<F\left(30\beta\,\omega^{\,III}\right)<\frac{225\beta}{\frac{\delta}{1-\delta}}$ because F is increasing. This implies that $\frac{F\left(30\beta\,\omega^{\,III}\right)}{\frac{225\beta}{\frac{\delta}{1-\delta}}}<1$ and hence , $\left[\frac{F\left(30\beta\omega^{II}\right)}{225\beta}-\frac{F\left(126\beta\omega^{III}\right)}{1323\beta}\right]$ is negative.