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THE EFFECTS OF CUSTOMS UNIONS ON THE PROCESS OF MULTILATERAL TRADE LIBERALIZATION: THE IMPORTANCE OF TIMING

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The effects of Customs Unions on the process of Multilateral Trade liberalization: The importance of timing

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Abstract

This paper explores a new dimension of the impact of Customs Unions on trade liberalization, largely ignored by the literature so far. That new dimension is the importance of timing of Customs Unions. I present a dynamic model in which the effects of Customs Unions differ depending on when they are formed. Customs Unions that happen in the later stages of trade liberalization are shown to be more likely to speed up that process. The trade liberalization framework is adapted from Staiger's 1995 model of Gradual Trade Liberalization. After extending the model to allow for more than two countries, I introduce the formation of Customs Unions. I then show under which conditions Customs Unions speed up and under which conditions they slow down the trade liberalization process. These show that Customs Unions are more likely to speed up trade liberalization in later rounds. Also, the Bagwell and Staiger result that high discount factors tend to make Customs Unions more beneficial to trade liberalization is confirmed.

1. Introduction

The recent proliferation of Regional Preferential trade Agreements (PTA's), such as Customs Unions and Free Trade Areas, has renewed the attention of the literature on their effects on the process of Multilateral trade Liberalization, as represented by the efforts of the WTO. The attitude of the WTO towards these agreements is clear. Article XXIV states that subject to a few relatively weak conditions, such agreements have a positive effect on trade liberalization and should be encouraged. Article XXIV grants an exception from Article I, better known as the Most Favored Nation Clause, to all PTA's. 144 PTA's were registered with the WTO up to now, 80 of which are still in effect. Nearly half of those agreements were registered in the last 7 years. Almost every single one of the 131 members of the WTO is involved in at least one. The latest example is the decision last December by the European Union to start expansion talks with 5 Eastern European countries and Cyprus.

Bhagwati (1996) characterizes this issue as the "dynamic time-path" issue. In other words, will the creation of PTA's lead to a shorter path to free trade or will it lead to a longer path. Most of the literature completely ignores the fact that this is essentially a dynamic issue and considers it in the context of static or stationary models of trade liberalization. This paper will examine the issue in the context of a non-stationary model of trade liberalization, the most appropriate context to study the issue. As the GATT rounds demonstrate trade liberalization is a non-stationary dynamic process. The purpose will be to present a model that resembles the GATT trade liberalization process and examine whether Customs Unions lead to a fewer number of rounds to get to free trade or rounds with lower tariffs.

Most of the literature uses Viner's (1950) classification of the effects of PTA's into trade creation and trade diversion as a starting point. Trade creation is the new trade created between members of a PTA because of the elimination of trade barriers, while trade diversion is trade diverted from non-members countries to member countries. Concerns about "fortress Europe" after the creation of the Common Market in 1992 echo concerns about trade diversion. In addition to these, Customs Unions are subject to a third effect, the market power effect. This refers to the increased negotiating power of Customs Unions, which gives them the ability to credibly impose higher tariffs on their trade partners. Perhaps surprisingly, a strong market power effect will lead to more cooperation in this model.

Krugman (1991), examines the issue in the context of a static monopolistically competitive model, and shows that PTA's can potentially increase external tariffs due to the non-cooperative behavior of large blocks. Krugman also introduces transportation costs, which establish "natural trading partners", and shows that in that case PTA's might be beneficial. Bhagwati and Panagariya (1996) also present a static model in which PTA's lead to higher external tariffs. They also address the "dynamic time-path" issue but not in the context of any specific model. They address a number of arguments for the formation of PTA's including "natural trading partners" and argue that each one of them is flawed.

Another approach is that of Bagwell and Staiger (1997). They study the issue in the context of stationary dynamic models. The trade liberalization model is one where countries play an infinitely repeated tariff setting game. This infinitely repeated game allows countries to sustain a cooperative tariff less than that in the static game. They then introduce the formation of different kinds of Free Trade Areas and Customs Unions. The existence of these PTA's makes the model non-stationary but the non-stationarities are associated with the PTA's and not the trade liberalization process. They conclude that in the case of Free Trade Areas there is going to be a temporary adverse effect on cooperative tariffs but the initial lower cooperative tariffs will eventually be restored. In the Customs Union case they find a temporary "honeymoon" phase with lower tariffs followed by a permanent increase in cooperative tariffs.

Dynamic models, stationary and non-stationary alike, explore the inability of countries to commit to policies that are individually suboptimal but collectively optimal. Staiger (1995) presented a non-stationary dynamic model of trade liberalization, which results in a process with a finite number of tariff reductions leading to free trade, resembling the GATT rounds. I extend this model to allow for more than countries and consider the effects of Customs Union formation in this context. This paper explores the non-stationarities in the Staiger model to conclude that Customs Unions are more likely to be beneficial to trade liberalization if they happen in later rounds of tariff reductions.

What is driving the non-stationaritiy in this model is the relocation of workers from the import competing sectors to the rest of the economy. The eventual demise of import competing industries and the relocation of their employees is always a major concern in trade liberalization. Ross Perot, in his 1992 and 1996 presidential campaigns claimed that he could hear a "giant sucking sound" sucking jobs to Mexico as a result of NAFTA. Pat Buchanan echoed the same concerns in his bid for the republican nomination in 1996.

Section 2 sets up the basic static structure of the model and considers Customs Union formation under these circumstances. Section 3 develops the dynamic stationary version of the model and examines Customs Union formation in that context. Sections 3 and 4 are designed to check if there are any discrepancies between the results of this model and other static or stationary models examined in the literature. Section 4 sets up the non-stationary version of the model and then allows for the formation of Customs Unions. Section 5 presents and analyses the results and examines the implications their for Article XXIV of the WTO.

2. The static model

I consider two types of countries, foreign countries denoted by a " * ", and home countries denoted by the absence of a " * ". There is K of each of the two types of countries. Both foreign and home countries are symmetrically grouped into R regions. Each region, therefore, has K/R countries. These regions are assumed to be custom unions.

There are only two traded goods, the domestic export good and the foreign export good. Countries share identical linear demands for the product of each industry. It is more convenient to sum up the demands within each region and present the demand curve for each region because regions, not countries, make tariff decisions.[1] Let the demand for each region be

$$D = \frac{1}{R}(\alpha - \beta P) \tag{1}$$

[1] In a custom union countries have common external tariffs.

where P is the price[2]. Production technologies in these two sectors are linear, with labor as the only input. One unit of effective labor produces one unit of output. Both types of countries can produce both goods so that each of them has an export sector and an import competing sector. Let τ and τ* represent the tariffs for any of the home and foreign regions respectively. Since the game is perfectly symmetric, in equilibrium all home regions will choose the same τ and all foreign regions the same τ*. Also let w_m, w_x, w_m* and w_x* denote the wage per effective labor unit in the import competing sector and the export sector of the home regions and the foreign regions respectively. Also, let P_m, P_x, P_m* and P_x* be the local prices of the goods. Then

$$w_m = P_m; w_x = P_x; w_m* = P_m*; w_x* = P_x* \quad (2)$$

The no arbitrage conditions are

$$P_m = P_x* + \tau; P_m* = P_x + \tau* \quad (3)$$

provided τ and τ* are not prohibitive. Finally, in addition to its export and import competing sector each region has a large rest of the economy sector, which is producing non-traded goods.

There are three types of labor in each of these economies. First there are workers that are particularly well suited to work in the import competing sector. Each of these workers is endowed with 1 unit of effective labor that is equally productive in the import competing and the rest of the economy sectors. In addition, each of these workers is endowed with γ units of sector specific effective labor that is useless outside the import competing sector. Therefore, each of these workers is endowed with 1 unit of effective

[2] This implies that the demand for each country is 1/(KR)*(α-βP).

labor if she works in the rest of the economy sector and $1+\gamma$ units if she works in the import competing sector. There are $e/(R(1+\gamma))$ such workers in each region. If all of them work in the import competing sector their effective labor supply is e/R. I will refer to these workers as import competing workers.

Also, each region has a large supply of workers, referred to as rest of the economy workers, who are endowed with 1 unit of effective labor equally productive in the rest of the economy and the import competing sectors. The supply of these workers into the import competing sector is infinitely elastic at the fixed rest of the economy wage rate of W. Finally, production in the export sector requires sector specific skills. Each region is endowed with E/R effective labor units. There is no movement in or out of this sector. This assumption will allow me to concentrate on movements in or out of the import competing sector. Such movements are always a big concern in trade negotiations and can be interpreted as jobs lost because of trade liberalization.

Consider the effective labor supply into the import competing sector. At a wage of W there is an infinitely elastic supply of labor into the sector from the rest of the economy workers. Since each unit of effective labor produces 1 unit of output, the domestic supply of the import good will also be infinitely elastic at the price W. For wages between W and $W/(1+\gamma)$ the only workers willing to work will be the import competing workers, because they can make more money by using their sector specific skills. The rest of the economy workers can make W in the rest of the economy sector so they will not supply any labor in this sector. The domestic supply of the import good will therefore be e/R. At wages less than $W/(1+\gamma)$ the supply of labor into this sector is zero, since even the import competing workers can make more by transferring to the rest of the economy sector.

The situation is illustrated in Figure 1, where D is the domestic demand for the import good. M is the region's demand for imports, defined as the difference between demand and domestic production. To study the effects of resource movements out of the import competing sector and their effects on trade liberalization, I will concentrate on the case where trade liberalization requires some import competing workers to relocate to the rest of the economy sector. This can only happen if the price after trade liberalization is $W/(1+\gamma)$, the price that leaves import competing workers indifferent between the import competing and the rest of the economy sectors. The export supply of the good must therefore intersect M at this price. The export supply is defined as the difference between the total production of the good (E) and the consumption of the rest of the World. For simplicity, I will concentrate on the case where free trade causes all import competing workers to relocate. X represents the export supply curve in Figure 1. This is equivalent to assuming that each region's export sector is large enough to exactly cover domestic demand for that region and the demand for a foreign region at the price $W/(1+\gamma)$. This is represented by the following condition

$$E = 2(\alpha - \beta \frac{W}{1+\gamma}) \tag{4}$$

Given this framework we can now establish the equilibrium domestic prices as functions of τ and τ^*.

$$P_m(t)=\begin{cases} W & \text{for } e/\beta+(2\gamma W)/(1+\gamma)\leq t \leq \tau' \\ W/(1+\gamma)+(t-e/\beta)/2 & \text{for } e/\beta \leq t \leq e/\beta+(2\gamma W)/(1+\gamma) \\ W/(1+\gamma) & \text{for } 0 \leq t \leq e/\beta \end{cases}$$

(5)

$$P_x(t^*)=\begin{cases} W-t^* & \text{for } e/\beta+(2\gamma W)/(1+\gamma)\leq t^* \leq \tau' \\ W/(1+\gamma)-(t^*+e/\beta)/2 & \text{for } e/\beta \leq t^* \leq e/\beta+(2\gamma W)/(1+\gamma) \\ W/(1+\gamma) & \text{for } 0 \leq t^* \leq e/\beta \end{cases}$$

(6)

where τ' is the prohibitive tariff. Domestic welfare is measured as the sum of consumer surplus, producer surplus and tariff revenue in the import sector and consumer surplus and producer surplus in the export sector. The social welfare function for each region r is given by

$$W(\tau,\tau^*) = \int_{P_{m(\tau_r)}}^{\frac{\alpha}{\beta}} \frac{1}{R}(\alpha-\beta P)dp + \int_{\frac{W}{1+\gamma}}^{P_{m(\tau_r)}} \frac{e}{R}dp + \tau_r[E-(\alpha-\beta P_x*(\tau)) - \frac{1}{R}\sum_{i\neq r}(\alpha - I_i e-(1-I_i)\beta\tau_i$$
$$-\beta P_m(\tau_i))] + \int_{P_{x(\tau^*)}}^{\frac{\alpha}{\beta}} \frac{1}{R}(\alpha-\beta P)dp + \int_{0}^{P_{x(\tau^*)}} \frac{E}{R}dP$$

(7)

where τ is the vector of tariffs of all the domestic regions and τ* is the vector of tariffs of all the foreign regions. I_i is defined as 1 if $\tau_i \geq e/\beta$ and 0 if $\tau_i < e/\beta$.

We can now formally define the game. The players are the governments of all regions, domestic and foreign, and the workers in each of these regions. Governments simultaneously choose tariffs first and then workers decide in which sector to work. Workers maximize their total wage[3] and governments maximize their social welfare functions $W(\tau,\tau^*)$ given by equation 7.

We can now derive the optimal (or Nash) tariff, τ_N, for each region. I will assume that the equilibrium optimal tariffs satisfy the following condition

$$\frac{e}{\beta} \leq \tau_N \leq \frac{e}{\beta} + \frac{2\gamma W}{1+\gamma} \tag{8}$$

This ensures that in equilibrium the optimal tariff is not going to be zero, which would imply a very trivial trade liberalization process. To show this assume that $\tau_N < e/\beta$. This is the case that Staiger (1995) considers. In this case, maximizing welfare is equivalent to maximizing tariff revenue because equilibrium prices are independent of tariff choices. Prices are always $W/(1+\gamma)$, therefore, tariff choices do not affect the producer or the consumer surplus in any sector. At a price of $W/(1+\gamma)$ the demand for imports is flat (see Figure 1). In this case, exporting regions will try to sell as much of their good as possible in the lowest tariff region because that way they can keep more of the $W/(1+\gamma)$ price. Each of the importing regions has the incentive to undercut the other regions in an effort to get more imports and consequently higher tariff revenue. This is analogous to a Bertrand price setting game and the equilibrium tariffs turn out to be zero. The trade liberalization process is very trivial and only lasts one period. Staiger was able to get a gradual trade liberalization process only because he assumed two countries, one home

[3] As opposed to their wage per effective labor unit.

and one foreign. In that case there is no competition between home regions for the same imports.

The case with the equilibrium price equal to W is also not interesting. At that price none of the import competing workers relocate to the rest of the economy. Once again that leads to a non-gradual trade liberalization process. The only interesting case is the one that satisfies condition 8. Integrating 7 and maximizing with respect to τ_r gives the optimal tariff for region r given the tariffs of all other regions[4]. That gives the following Reaction Function

$$\tau_r = \frac{E - e + 2\beta \sum_{i \neq r} \tau_i}{\beta(4R - 1)} \tag{9}$$

Since this is a symmetric game all regions will choose the same tariff in equilibrium. Given this and equation 9 we can derive the Nash Equilibrium tariff, τ_N, as follows

$$\tau_N = \frac{E - e}{\beta(2R + 1)} \tag{10}$$

Note that since the markets for the two traded goods are independent, the optimal tariff of domestic regions is independent of the optimal tariff of foreign regions. Also note that

$$\frac{\partial \tau_N}{\partial e} < 0 \tag{11}$$

This suggests that increasing the number of import competing workers will decrease the optimal tariffs. The intuition behind this result is the following. The number of import competing workers affects both the marginal cost and the marginal benefit of increasing

[4] The tariffs of all domestic regions are assumed to satisfy condition 8, which implies I_i=1 for all i.

τ_N. The marginal cost of increasing τ_N is that it will increase domestic prices and thus lower consumer surplus in this sector. This effect dominates all others.

The marginal benefit is a combination of two effects. The first is that a higher τ_N increases the domestic price of the good and thus leads to higher rents being earned by the import competing workers. The second effect is that a higher tariff leads to higher tariff revenues. The impact of increasing e on this latter effect is a combination of two effects pushing in opposite directions:

1) Increasing the number of import competing workers lowers the price of the good in the rest of the world, domestic and foreign countries alike. This leads to a lot more of the good being consumed in the rest of the World leaving less for import in the region in question.
2) A higher e leads to more of the good being produced domestically in the rest of the domestic regions increasing the quantity of the good available for import by this region.

It turns out that the former always outweighs the latter leading to a decrease in the quantity of the good available for import lowering the marginal increase in tariff revenue as a result of higher tariffs. Increasing e also leads to a lot more import competing workers earning rents. It turns out that these two effects cancel each other out. This is in no way necessary for the result.

The only thing left is the effect on consumer surplus. A larger e means that the change in the tariff will happen at a lower price. That will have a much bigger impact on consumer surplus than if the same change in tariffs happened at a higher price because a lot more consumers are affected. In other words when price is low demand is more elastic. This is illustrated in Figure 2. As long as elasticity is increasing with the quantity demanded this holds true.

So increasing the number of import competing workers increases the marginal cost of an increase in tariffs but leaves the marginal benefit unchanged. This of course means that lowering your tariff can increase welfare. Therefore, a higher e leads to a lower tariff.

The formation of Customs Unions in the static model

This section will introduce Customs Unions to the static model. Customs Unions will be represented by a fall in the number of regions R. To keep the model symmetric at all times, I will assume that R is the same for domestic and foreign regions before and after the formation of Customs Unions. In the static case, I will only consider the effect of a lower R on the optimal Nash tariff, τ_N, ignoring any dynamic issues.

Customs Unions can be thought of as having a trade creation, a trade diversion and a market power effect. The later is only present in Customs Unions, while the other two are present in Free trade Areas as well. Under a Customs Union, members adopt the same external tariffs, which allows the Customs Union to credibly impose higher tariffs. This paper will concentrate exclusively on the market power effect and leave the examination of trade creation and trade diversion for future work.

From equation 10 note that

$$\frac{\partial \tau_N}{\partial R} < 0 \qquad (12)$$

This suggests that a fall in R, i.e. a Customs Union, will increase the optimal Nash tariff, τ_N. This is because the newly formed bigger regions internalize the incentive for higher tariffs. In other words, a decrease in R will lead to a bigger import competing sector and thus more rents and leave more of the import good available for each region. The marginal benefit of increasing tariffs therefore increases because of an increase in rents earned and an increase in tariff revenue. This more than outweighs the increase in the marginal cost of increasing tariffs due to the lost consumer surplus. The loss of consumer surplus is higher because the bigger region has more consumers now. Therefore, a fall in R increases the marginal benefit of increasing the tariff more than the marginal cost, leading to an increase in equilibrium tariffs. This is just a demonstration of the market power effect. The market power effect basically depends on how much of the market you control compared to the other regions. This confirms the result by previous papers dealing with static models which suggests that Customs Unions lead to higher equilibrium tariffs to non-member countries.

Another interesting question is the issue of whether regions are better off after Customs Unions. Reducing R has two effects on welfare. The first effect is that the new region gets a higher welfare by simply adding up the welfare of more countries. The second and more interesting effect is that a fall in R leads to a rise in the equilibrium tariff. We can adjust for the first effect by considering the sum of the welfare of all the domestic countries together and thus isolate the second effect. We can then establish that

$$\frac{\partial RW(\tau_N, \tau_n)}{\partial R} > 0 \qquad (13)$$

This suggests that a fall in R due to the formation of a Customs Union will lead to a fall in the total welfare for domestic countries. The intuition behind this result is fairly simple. A fall in R leads to higher tariffs, which lead to lower welfare.

Bhagwati and Panagariya (1996) discuss this issue qualitatively (not in the context of any specific model) and conclude that the welfare implications are ambiguous. In the context of this model we get a definite answer to the question. That answer is that Customs Unions reduce per capita welfare by increasing tariffs.

3. Stationary dynamic tariff setting

In this section I will allow regions to coordinate their tariff policies subject to the condition that the agreement is self-enforcing. This opportunity can be provided by an international organization such as the World Trade Organization (WTO). Since the WTO has no enforcement powers any cooperation must be self-enforcing.

Let's define the new game as an infinite repetition of the game in the previous section. This new game is stationary because the parameters of the model remain the same through time. Any solution must satisfy the following conditions:

1. The equilibrium is a symmetric and subgame perfect. (All regions domestic and foreign choose the same tariff)
2. If a deviation from the agreed tariff occurs, then all regions revert to Nash equilibrium forever[5].
3. From the equilibria satisfying the above, pick the most-cooperative equilibrium. This is the equilibrium with the lowest cooperative tariff.

[5] The results will change if autarky punishments are considered.

A well-established result in the Industrial Organization literature is the Folk theorem. Applied to this setting it implies that a tariff lower than the Nash tariff might be sustainable because the one time gain from deviating from this tariff might be outweighed by the discounted value of the future loss of cooperation.

Assume that the cooperative tariff, τ_c, satisfies the following condition:

$$\tau_c \leq \frac{e}{\beta} \tag{14}$$

This is necessary if any of the import competing workers are going to have to relocate to the rest of the economy sector. If regions set their tariffs to τ_c then $I_i=0$ for all regions.

If a region is going to cheat, it will deviate according to its best response function or its reaction function, given that everyone is playing τ_c. Note that the reaction function is not the same as that in equation 9 because that was derived based on the fact that $I_i=1$ for all i, but in this case $I_i=0$ for all i. In other words, all the import competing workers were employed in the import competing sector in the Nash cases but not all of them are employed in that sector now. Integrating 7 and setting $\tau_i=\tau_c$ for all i, and maximizing with respect to τ_r we can derive the following reaction function:

$$\tau_D = \frac{E-(2R-1)e+4(R-1)\beta\tau_c}{\beta(4R-1)} \tag{15}$$

This reaction function[6] has the same qualitative properties as the Nash reaction function but the slopes are different. This is because of two differences. The first is that the price of the import good in the other domestic regions is independent of the size of the import competing sector. That price is of course $W/(1+\gamma)$. The production in the import competing sector in these regions is also independent of the size of the import competing sector. This is because not all of the import competing workers are working in this sector. The number that remains in this sector is determined by the tariff τ_c. Therefore, it doesn't matter how big your import competing sector is only $\beta\tau_c/(1+\gamma)$ will remain in this sector. Therefore, we have

$$\frac{\partial \tau_D}{\partial e} < 0$$
$$\frac{\partial \tau_D}{\partial R} < 0 \qquad (16)$$

It is important to note that the impact of changing e on the deviating tariff is bigger than its impact on the Nash tariff. The only difference between the two cases is in the reduction of the marginal benefit of increased tariff revenue. This is because an increase in e does not change the production in the other domestic regions (effect 2 on the tariff revenue above). The reason is that every other domestic region is cooperating by setting their tariffs equal to τ_c and in that case production of the imported good is only dependent on τ_c not e. This leads to the foreign countries keeping more of the good for themselves and exporting less to the region. Therefore, increasing e leads to an even higher increase in the marginal cost of increasing tariffs compared to the increase in the marginal benefit leading to an even greater negative slope.

In Staiger (1995) an increase in e leads to an increase in the deviating tariff. The reason these results are different is because Staiger considers deviations that are below e/β. This eliminates the consumption effect leaving only the tariff revenue effect. In my case the negative consumption effect outweighs the tariff revenue effect.

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[6] The assumption is that $e/\beta \leq \tau D \leq (e/\beta)+2\gamma W/(1+\gamma)$.

Equation 16 also demonstrates that the market power effect is present in this case as in the Nash case. Again, the market power effect depends on how much of the market you control compared to the other regions. In this case the market power effect is a bit weaker than in the Nash case for two reasons. The first is that regions do not face the same tariff complementarity effect as in the Nash case. Recall that for the Nash case, an increase in tariffs increases the tariffs of other domestic regions which in turn makes it more advantageous to increase tariffs even further (see equation 9). The second is that e has a much bigger negative impact on τ_D requiring a larger reduction in R for the same effect in τ_D.

Setting all tariffs equal to τ_c and integrating equation 7 we get

$$W(\tau_c,\tau_c)=\frac{\alpha^2}{\beta R}-\frac{\beta}{R}\left(\frac{W}{1+\gamma}\right)^2-\frac{\beta}{2R}\tau_c^2 \tag{17}$$

Equation 17 gives the welfare if all regions foreign and domestic cooperate. Note that this welfare is independent of e because all prices are W/(1+γ) and the amount of workers employed in the import competing sector is only dependent of the tariff. There is a simple intuition for the fact that the amount of import competing workers is independent of the size of the import competing sector. That is the fact that not all of them will be employed. The tariff will determine how many of them will be employed in that sector and the rest, no matter how many these are, will have to relocate.

If a region deviates, equation 15 gives the best deviating tariff. Setting all tariffs equal to τ_c for all other regions and τ_D for the deviating country we get the welfare for the deviating country as

$$W(\tau_D,\tau_c)=\frac{\alpha^2}{\beta R}-\frac{2\alpha W}{R(1+\gamma)}+\frac{\beta W^2}{R(1+\gamma)^2}+\tau_D(\frac{E-e-4(R-1)\beta\tau_c}{4R})-\frac{\beta\tau_D^2}{2}\frac{(4R-1)}{4R}$$
$$+E(\frac{e}{4R\beta}-\frac{\tau_c}{2R}-\frac{W}{R(1+\gamma)})-\frac{3e^2}{8R\beta}+\frac{\beta\tau_c^2}{2R} \tag{18}$$

where τ_D is given by equation 15. Setting all tariffs equal to the Nash tariff we get

$$W(\tau_N,\tau_N)=\frac{\alpha^2}{\beta R}-\frac{2\alpha W}{R(1+\gamma)}+\frac{\alpha e}{\beta R}+\frac{\beta W^2}{R(1+\gamma)^2}-\frac{eW}{R(1+\gamma)}-\frac{\beta\tau_N^2}{4R}-\frac{e^2}{4R\beta}+$$
$$\frac{EW}{R(1+\gamma)}-\frac{eE}{2R\beta} \tag{19}$$

where τ_N is given by10.

At any time t, a region can either choose to cooperate and play the cooperative tariff, or deviate and get the increased welfare from deviating that period and Nash welfare from then on. Cooperating is a subgame perfect equilibrium if

$$W(\tau_c,\tau_c)\geq(1-\delta)W(\tau_D,\tau_c)+\delta W(\tau_N,\tau_N)\equiv V(\tau_c,\delta) \tag{20}$$

where δ is the symmetric discount factor. The lowest tariff satisfying 20 will be the one that makes 20 hold with equality. I will concentrate on the cases where this tariff is strictly positive because the zero tariff will lead to free trade right away. In that case the path to free trade will be trivial. This condition imposes a maximum value on δ. If $\delta=1$ the gain from cooperating is $W(\tau_c,\tau_c)$ and the gain from deviating $W(\tau_N,\tau_N)$. That will mean that all tariffs less than τ_N will be subgame perfect. The lowest is of course zero leading to a trivial trade liberalization process. Let d be the discount factor that satisfies

$$W(\tau_c=0,\tau_c=0)=(1-d)W(\tau_D(\tau_c=0),\tau_c=0)+dW(\tau_N,\tau_N) \tag{21}$$

Let $\delta\in[0,d)$.

Equilibrium and Comparative statics

To establish the properties of the equilibrium tariff it is necessary to investigate the properties of the welfare functions above. Note that $W(\tau_c,\tau_c)$ is concave in τ_c and decreasing for $\tau_c \in [0,e/\beta]$. In other words

$$\frac{\partial W(\tau_c,\tau_c)}{\partial \tau_c} < 0$$
$$\frac{\partial^2 W(\tau_c,\tau_c)}{\partial {\tau_c}^2} < 0 \tag{22}$$

$W(\tau_c,\tau_c)$ is maximized at $\tau_c=0$, demonstrating that all regions are better off with free trade. $W(\tau_D,\tau_c)$ has the same shape or in other words

$$\frac{\partial W(\tau_D,\tau_c)}{\partial \tau_c} < 0$$
$$\frac{\partial^2 W(\tau_D,\tau_c)}{\partial {\tau_c}^2} < 0 \tag{23}$$

From 10 and 19 notice that $W(\tau_N,\tau_N)$ is independent of τ_c. The Nash welfare only depends on the Nash tariff and it is the same no matter what τ_c is. Therefore

$$\frac{\partial V(\tau_c,\delta)}{\partial \tau_c} < 0$$
$$\frac{\partial^2 V(\tau_c,\delta)}{\partial {\tau_c}^2} < 0 \tag{24}$$

Proposition 1: At $\tau_c=0$, $W(\tau_c,\tau_c)<V(\tau_c,\delta)$ for discount factors in [0,d].

Proof: From 21 notice that at δ=d and τ_c=0, $W(\tau_c,\tau_c)=V(\tau_c,\delta)$. $W(\tau_D,\tau_c) > W(\tau_c,\tau_c)$ since by definition $W(\tau_D,\tau_c)$ is a best response to τ_c. We also know that $W(\tau_c,\tau_c) > W(\tau_N,\tau_N)$. If not then the trade liberalization process is trivial since no tariff lower than Nash can be supported. From 20 observe that $V(\tau_c,\delta)$ is a weighted average of $W(\tau_N,\tau_N)$ and $W(\tau_D,\tau_c)$. As the value of δ is lowered the weight on $W(\tau_N,\tau_N)$ decreases and the weight on $W(\tau_D,\tau_c)$ is increased. This implies that $V(\tau_c,\delta)$ is increased as δ is lowered. Since at the highest value for δ $W(\tau_c,\tau_c)=V(\tau_c,\delta)$, then for $\delta \in [0,d)$ $W(\tau_c,\tau_c)<V(\tau_c,\delta)$. **QED**

Also define d* as

$$W(\tau_c = \frac{e}{\beta}, \tau_c = \frac{e}{\beta}) = (1-d^*)W(\tau_D(\tau_c = \frac{e}{\beta}), \tau_c = \frac{e}{\beta}) + d^*W(\tau_N, \tau_N) \tag{25}$$

If the discount factor is zero then the right hand side of 25 is $W(\tau_D,\tau_c)$. By definition $W(\tau_D,\tau_c) > W(\tau_c,\tau_c)$. Since $\tau_N > e/\beta$ and $\tau_c = e/\beta$ $W(\tau_c,\tau_c) > W(\tau_N,\tau_N)$. So as δ is increased from zero the weight on $W(\tau_D,\tau_c)$ decreases and the weight on $W(\tau_N,\tau_N)$ increases lowering the right hand side of 25. At δ=d* the two sides of 25 are equated.

Proposition 2: At $\tau_c = e/\beta$, $W(\tau_c,\tau_c)>V(\tau_c,\delta)$ for discount factors in [d*,1].

Proof: At δ=d* $W(\tau_c,\tau_c)=V(\tau_c,\delta)$ by equation 25. As δ is increased less weight is placed on $W(\tau_D,\tau_c)$ and more on $W(\tau_N,\tau_N)$ decreasing the value of $V(\tau_c,\delta)$ and leaving $W(\tau_c,\tau_c)$ unaffected. Since at d* $W(\tau_c,\tau_c)=V(\tau_c,\delta)$, then for $\delta \in [d^*,1]$ $W(\tau_c,\tau_c)>V(\tau_c,\delta)$. **QED**

I will assume that d*<d. The significance of this assumption will be discussed after the proof of proposition 3.

<u>Proposition 3</u>: For $\delta \in (d^*,d)$, the equilibrium cooperative tariff as defined above is in the interval $(0,e/\beta)$ and it is unique.

<u>Proof</u>: From proposition 1 and 2 we know that $W(\tau_c,\tau_c)<V(\tau_c,\delta)$ at $\tau_c=0$ and $W(\tau_c,\tau_c)<V(\tau_c,\delta)$ at $\tau_c=e/\beta$. Also, from 22 and 24 we know that both functions are concave and decreasing in this region. Since both functions are second degree polynomials, they are continuous. That implies that $W(\tau_c,\tau_c)=V(\tau_c,\delta)$ somewhere in $(0,e/\beta)$. The solution is unique because both these functions are the decreasing portion of second degree polynomials. **QED**

Figure 3 demonstrates the two functions and the equilibrium. Also note that the existence of the equilibrium in this region was implicitly assumed by requiring that d*<d, or in other words that (d*,d) is not empty. If $\delta>d$ then $\tau_c=0$. If $\delta<d^*$ then the only equilibrium is the Nash equilibrium. Both cases will lead to trivial trade liberalization processes.

I now consider the effect of the size of the import competing sector e on the welfare functions. Recall that $W(\tau_c,\tau_c)$ is independent of e. To derive the effect of e on $W(\tau_D,\tau_c)$ and $W(\tau_N,\tau_N)$ I have to consider the impact of e on each of the components of a region's welfare.

Let me consider $W(\tau_N,\tau_N)$ first. An increase in e will lead to a lower equilibrium price for the import good which will lead to an increase in consumer surplus in that sector. The same increase in e will lead to a larger rent earning sector (recall that all import competing workers are employed in this case) further increasing welfare. Since the model is symmetric, a higher e will lead to a lower price of the export good in the foreign regions and through arbitrage a lower price in the domestic region. That will increase the consumer surplus in the export sector too. The lower price in the export sector will lower the producer surplus in the export sector thus lowering welfare. Taking the export sector as a whole the impact on consumer surplus always outweighs that on producer surplus[7]. The only thing remaining is the impact on the tariff revenue. A higher e will lead to lower prices in the foreign regions. As a result these regions consume more of the product leaving less of it to the importing region. In the other domestic regions prices also fall leading to more overall demand for the product but at the same time a higher e leads to more internal production. This production effect is always bigger than the production effect leading to a lower import demand by the other domestic regions. In effect, there is more demand for the good in the foreign regions and less import demand in the domestic regions. The former always outweighs the latter so a higher e leads to less of the good being imported and lowers tariff revenue. So, a higher e will increase $W(\tau_N,\tau_N)$ by increasing consumer surplus in both sectors and by increasing rents in the import competing sector. $W(\tau_N,\tau_N)$ is going to be reduced by the negative impact on tariff revenue and the export producer surplus. We therefore have,

$$\frac{\partial W(\tau_N,\tau_N)}{\partial e} > 0 \tag{26}$$

[7] This is because producer surplus is proportional to e while consumer surplus is proportional to e^2.

subject to

$$E - 2e(2R^2 + 2R + 1) > 0 \tag{27}$$

This condition is basically ensuring that the export sector is large enough compared to the import competing sector. Recall that the impact of the export sector as a whole is to increase $W(\tau_N,\tau_N)$. The bigger this sector is the larger the positive impact e will have on $W(\tau_N,\tau_N)$.

I will now consider the impact of e on $W(\tau_D,\tau_c)$. The impact on the import competing sector will be exactly the same. Recall that in this case too all import competing workers are working in the rent-earning sector for the deviating region. Since every other region is cooperating there will be no impact on the export sector. Recall that when regions are cooperating prices are independent of e and fixed at $W/(1+\gamma)$. Also from the earlier discussion recall that the negative impact on the tariff revenue is larger than in the Nash case. Therefore, the negative side in this case is bigger than the Nash case and the positive side is smaller. This means that the impact on $W(\tau_D,\tau_c)$ is at best ambiguous.

Also from equation 20 notice that as δ increases the weight on $W(\tau_D,\tau_c)$ decreases and that on $W(\tau_N,\tau_N)$ increases. Therefore for δ high enough we have

$$\frac{\partial V(\tau_c,\delta)}{\partial e} > 0 \tag{28}$$

Also form 18 we get

$$\frac{\partial^2 W(\tau_D,\tau_c)}{\partial e \partial \tau_c} = 0$$

(29)

From 29 and the fact that $W(\tau_N,\tau_N)$ is independent of τ_c we get

$$\frac{\partial^2 V(\tau_c,\delta)}{\partial e \partial \tau_c} = 0$$

(30)

Equations 28 and 30 are going to make sure that as import competing workers relocate the equilibrium tariffs go down. Figure 4 demonstrates this result. This is going to be crucial in the dynamic versions of the model. Intuitively, as a region's import competing workers become less their incentive to deviate is lowered because if they deviate they can not keep prices as low and also can not earn as much in the form of rents.

The formation of Customs Unions in a stationary dynamic model

Figure 3 established the lowest cooperative tariff that can be supported in a stationary dynamic model with a fixed number of regions. In this section I am going to expand that model to allow for Customs union formation. This Customs union formation will be represented by a fall in the number of regions from R_0 to R_1. As in the static case this fall in the number of regions is symmetric, or in other words it happens at the same time for domestic and foreign regions. Once Customs Unions are formed they can observe this before they make their tariff decisions for that period. For simplicity assume that this can happen only once. Customs Unions happen because of exogenous political factors. Regions are completely surprised by their formation. Appendix B will show that the results can be generalized for more realistic Customs Union formation processes.

The new game is the following. Regions play the same game as above except from the fact that their strategies are now dependent on R. The equilibrium is defined as the subgame perfect equilibrium of this game that satisfies

1) Along the equilibrium path, all domestic and foreign regions choose the same tariffs.
2) If a deviation occurs, regions revert to playing Nash Equilibrium forever.
3) From the equilibria satisfying the above, pick the most-cooperative equilibrium. This is the equilibrium with the lowest cooperative tariff.

As in the static case Customs Union formation will have two effects. The first is that they will increase welfare for each region because they are now bigger regions. In other words, fewer regions now share the same welfare. As in the static case I will avoid this complication by considering the total welfare for domestic regions. The second effect is of course the market power effect. This will affect the Nash and the deviating tariffs.

To assess whether Customs Union formation will benefit the process of trade liberalization or not, I need to characterize the equilibrium tariff before and after Customs Union formation. The equilibrium tariff will be determined by the following incentive constraint

$$R_t W_t(\tau_c, \tau_c) \geq (1-\delta) R_t W_t(\tau_D(\tau_t{}^c, R_t), \tau_t{}^c) + \delta R_t W_t(\tau_N(R_t), \tau_N(R_t)) \equiv V_t \tag{31}$$

From equation 17 notice that $RW(\tau_c,\tau_c)$ is independent of R, for all R. This means that the total welfare of all domestic regions will be unaffected by the number of regions. This is hardly surprising since that is the point of cooperation. In other words, cooperating regions try to maximize total welfare and then divide that welfare among them. Therefore, the right hand side of 31 will be independent of R.

I will now consider the effect of lowering R from R_0 to R_1 on V_t. If Customs Union formation is going to lead to a lower cooperative tariff then the following must hold:

$$\frac{\partial V_t}{\partial R} > 0$$
$$\frac{\partial^2 V_t}{\partial R \partial \tau_c} > 0 \tag{32}$$

If the signs are reversed then Customs Unions are going to lead to a higher cooperative tariff and thus slow down the trade liberalization process. It turns out that the second derivative is always positive so I will concentrate attention on the first derivative. Recall that V_t is just the weighted average of the deviating and the Nash welfare. This derivative will also be the weighted average of the derivatives of these two expressions. The exact functional form of these derivatives appears in Appendix A.

The intuition behind 32 is relatively straightforward. Customs Unions will be beneficial if the market power effect is strong. The market power effect will allow regions to increase their deviating tariff and their Nash tariffs. Increasing the Nash tariffs means lowering the Nash welfare and thus increasing the cost of deviating. Increasing the deviating tariff means increasing the one time gain from deviating. If the former dominates the latter then the cost of deviating increases more and thus more cooperation can be supported.

Figure 5 illustrates the results. The derivative with respect to the Nash welfare is always positive while that of the deviating welfare is negative. This means that according to the specific values of the parameters Customs Unions benefit or not the trade liberalization process. Also, the model confirms the result by Bagwell and Staiger that a higher discount factor will make it more likely that Customs unions are going to speed up trade liberalization. To illustrate this notice that a higher δ will increase the weight of $\partial W(\tau_N,\tau_N)/\partial R$ and decrease that of $\partial W(\tau_N,\tau_N)/\partial R$. The former is always positive while the latter is negative. Therefore, a high δ will tend to make $\partial V_t/\partial R$ more positive and Customs Unions more beneficial to trade liberalization. The intuition behind this result is the following. Customs Unions will increase the benefit of deviating and the cost of deviating at the same time. The increase in the benefit occurs right away while the increase in the cost is incurred in the future. The higher the value of δ the more important the future is making the increase in cost dominant.

4) The non-stationary dynamic case

The movement from τ_N to τ_c is thought of as representing the trade liberalization process of the WTO. The problem is that the stationary model above only allows for a one-time reduction in tariffs. To meaningfully discuss whether Customs Unions slow down or speed up the trade liberalization process a dynamic model with a series of tariff reductions is needed. Such a model would mirror what was observed since the creation of GATT after World War II. GATT would initiate rounds of negotiations every few years that would lead to tariff reductions. The latest round was of course the Uruguay Round, which established the WTO. The purpose of this section is to present such a model and study Customs Union formation in that context.

In the previous section it was established that a drop in e would lead to a drop in the equilibrium cooperative tariff. Recall that when regions are cooperating only $\beta\tau_c$ domestically produced by the import competing sector. Assume that the import competing workers that leave the import competing sector eventually lose their sector specific skills because of lack of use. That will permanently reduce the value of e. This is going to provide the non-stationary structure we need to model the GATT rounds.

Assume that every region starts with $e_1/(1+\gamma)$ import competing workers. Workers first observe all the tariff choices by all domestic and foreign regions and then decide to work either in the import competing or the rest of the economy sector. Under cooperation some of them have to relocate to the rest of the economy sector. For these workers there is a constant probability μ that they will lose their sector specific skills in the next period. If this happens then these workers become identical to the rest of the economy workers. The possibility of depreciation of sector specific skills happens at the beginning of each period and that depreciation occurs simultaneously for all workers that left the import competing sector. Workers can not obtain sector specific skills if they don't have them. Also, note that the model is one of complete and perfect information and whether workers keep or lose their skills becomes common knowledge as soon as it is determined. Regions know this before they make their tariff choices.

I will define the state of the import competing workers by the effective labor supply in that sector at any point in time. Let i=1,2.... index the history of states. Each region starts with e_1 and after the first round of skill depreciation they are left with e_2 and so on. In other words, e_i denotes the state after i-1 rounds of skill depreciation. The equilibrium is then defined as follows:

1) Along the equilibrium path, in any state i, region's select a common tariff τ_c^i at all dates associated by that state.

2) If at any time a deviation occurs, regions revert to Nash tariffs from the next period forever.

3) Out of the subgame perfect equilibria satisfying the above pick the most cooperative one, i.e. the one with the lowest cooperative tariff.

I will assume that free trade is achievable in a finite number of states or rounds of liberalization. These of course can be thought of as the GATT rounds. Let free trade be achievable in n rounds. Starting from round n, the model can be solved recursively for the most cooperative trade liberalization path $\{\tau_c^1, \tau_c^2 ... \tau_c^n\}$.

In any state i, there are $\beta\tau_c^i$ import competing workers employed in the import competing sector. After a round of depreciation only these workers will retain their sector specific skills. The total supply of import competing workers in the next state, e_{i+1} is

$$e_{i+1} = \beta\tau_c^i \tag{33}$$

for i=1,2...n-1. In state n there are no import competing workers left.

If workers observe any region deviating from τ_c^i then they all return to the import competing sector to enjoy the rents in that sector. Using 33 we can rewrite 17, 18 and 19 as follows:

$$W_i(\tau^i{}_c, \tau^i{}_c) = \frac{\alpha^2}{\beta R} - \frac{\beta}{R}\left(\frac{W}{1+\gamma}\right)^2 - \frac{\beta}{2R}(\tau_c^i)^2 \tag{34}$$

$$W_i(\tau_D^i, \tau_c^i, e_i(\tau_c^{i-1})) = \frac{\alpha^2}{\beta R} - \frac{2\alpha W}{R(1+\gamma)} + \frac{\beta W^2}{R(1+\gamma)^2} + \tau_D^i(\frac{E - e_i(\tau_c^{i-1}) - 4(R-1)\beta\tau_c^i}{4R})$$
$$- \frac{\beta(\tau_D^i)^2}{2}\frac{(4R-1)}{4R} + E(\frac{e_i(\tau_c^{i-1})}{4R\beta} - \frac{\tau_c^i}{2R} - \frac{W}{R(1+\gamma)}) - \frac{3(e_i(\tau_c^{i-1}))^2}{8R\beta} + \frac{\beta(\tau_c^i)^2}{2R} \tag{35}$$

$$W_i(\tau_N^i, \tau_N^i, e_i(\tau_c^{i-1})) = \frac{\alpha^2}{\beta R} - \frac{2\alpha W}{R(1+\gamma)} + \frac{\alpha e_i(\tau_c^{i-1})}{\beta R} + \frac{\beta W^2}{R(1+\gamma)^2} - \frac{e_i(\tau_c^{i-1})W}{R(1+\gamma)} - \frac{\beta(\tau_N^i)^2}{4R}$$
$$- \frac{(e_i(\tau_c^{i-1}))^2}{4R\beta} + \frac{EW}{R(1+\gamma)} - \frac{e_i(\tau_c^{i-1})E}{2R\beta} \tag{36}$$

Since free trade is achieved in n rounds $\tau_c^{i+j} = \tau_c^n = 0$ and $W_{i+j} = W_n$ for $j \geq n-j$. Define Z_i as the discounted welfare under cooperation into the infinite future as viewed from a period in state i. The cooperative tariff, τ_c^i, will be defined by the following incentive constraint[8]:

$$W_i(\tau_D^i, \tau_c^i, e_i(\tau_c^{i-1})) - W_i(\tau_c^i, \tau_c^i) \leq Z_i - \frac{\delta}{1-\delta} W_i(\tau_N^i, \tau_N^i, e_i(\tau_c^{i-1})) \tag{37}$$

Starting with round n we know that $\tau_c^n = 0$ by assumption. From this point on the game is stationary just like the game in the previous section and $Z_n = (\delta/(1-\delta))W_n(\tau_c^n=0, \tau_c^n=0)$. Equation 37 will then implicitly define the range for τ_c^{n-1} as follows:

$$W_n(\tau_c^n = 0, \tau_c^n = 0) = (1-\delta)W_n(\tau_D^n(\tau_c^n = 0), \tau_c^n = 0, e_i(\tau_c^{n-1*})) + \delta W_n(\tau_N^n, \tau_N^n, e_i(\tau_c^{n-1*})) \tag{38}$$

38 defines τ_c^{n-1*}. τ_c^{n-1} is therefore in the range $[0, \tau_c^{n-1*}]$. Equation 37 is equivalent to

[8] This is analogous to the constraint in equation 20.

$$W_i(\tau_D^i, \tau_c^i, e_i(\tau_c^{i-1})) - W_i(\tau_c^i, \tau_c^i) \leq$$
$$\frac{\delta}{1-\delta(1-\mu)}[(1-\mu)W_i(\tau_c^i, \tau_c^i) + \mu W_{i+1}(\tau_c^{i+1}, \tau_c^{i+1}) + Z_{i+1}] + \frac{\delta}{1-\delta} W_i(\tau_N^i, \tau_N^i, e_i(\tau_c^{i-1}))$$

(39)

Recall that for the most cooperative trade liberalization path 39 must hold with equality. Using 39 we can recursively define ranges for all τ_c^i (i = 1, 2..., n-1). Evaluating 37 for i+1, multiplying both sides by $\delta\mu/(1-\delta(1-\mu))$ and subtracting from 39 evaluated for i, we get

$$W_i(\tau_c^i, \tau_c^i) \geq \frac{1-\delta(1-\mu)}{\delta(1-\mu)}[W_i(\tau_D^i, \tau_c^i, e_i(\tau_c^{i-1})) - W_i(\tau_c^i, \tau_c^i) + \frac{\delta}{1-\delta} W_i(\tau_N^i, \tau_N^i, e_i(\tau_c^{i-1}))$$
$$- \frac{\mu}{1-\mu}[W_{i+1}(\tau_D^{i+1}, \tau_c^{i+1}, e_{i+1}(\tau_c^i)) + \frac{\delta}{1-\delta} W_{i+1}(\tau_N^{i+1}, \tau_N^{i+1}, e_{i+1}(\tau_c^i))]$$

(40)

Setting 40 to equality we can define a function $\tau_c^i(\tau_c^{i-1})$. Using this function we can solve recursively for the trade liberalization path given an initial tariff τ_c^1. Figure 6 illustrates the process. $\tau_c^i(\tau_c^{i-1})$ is represented as a monotonically increasing function below the 45° line ensuring that tariffs decrease through time. The figure sets n=5. The right hand side quadrant illustrates the trade liberalization path.

We now have a dynamic trade liberalization process driven by the fact that before every round of trade liberalization we have a round of skill depreciation. Import competing workers caught in the rest of the economy sector when sector specific skills depreciate lose their skills and become rest of the economy workers. This lowers the rent earning ability of regions when they deviate by lowering the Nash payoff more than they increase the deviating payoff while leaving the cooperative welfare unaffected. This of course makes lower cooperative tariffs possible in the next period. This is repeated until all import competing workers become rest of the economy workers and the World achieves free trade.

Customs Union formation in the non-stationary dynamic case

Customs Unions are formed in exactly the same manner as in the stationary case described in the previous section. They happen for exogenous reasons, they are symmetric and they happen only once. Again, the results are confirmed for a more general Customs Union process in Appendix B. Regions play the same game as above but in this case their strategies depend on both e and R. The equilibrium is defined as follows:

1) Along the equilibrium path all regions, domestic and foreign, choose the same tariff.
2) If a deviation occurs, regions revert to their Nash strategies forever.
3) Out of the subgame perfect equilibria satisfying the above pick the most cooperative one.

Define D_i as the discounted welfare of cooperation. This will be a weighted average of $W_j(\tau_c^j,\tau_c^j, R_p)$ for j=1,2...n and p=0,1. These weights will depend on δ and μ. In a period in state i the following incentive constraint will determine the equilibrium cooperative tariff:

$$\frac{R_p D_i(R_p)}{1-\delta} \geq (1-\delta)R_p W_i(\tau_D,\tau_c,R_p)+\delta R_p W_i(\tau_N,\tau_N,R_p)\equiv V_{iR} \qquad (41)$$

As in earlier sections Customs Unions have two effects. The first is to increase all welfares by dividing total welfare between larger regions and the second is the market power effect. Multiplying all welfares by R_p neutralizes the first effect. In this way we isolate the effects of the market power effect. Notice that the left-hand side of 41 is once again unaffected by the market power effect. Briefly this is due to the fact that this is just the total welfare under cooperation which is what cooperation maximizes. Therefore, Customs Unions only affect the benefit of deviating (V_{iR}).

The market power effect will increase the deviating tariff and the Nash tariff at the same time. Again this will increase both the cost of deviating (by decreasing Nash Welfare) and the benefit of deviating (by increasing deviating welfare). Customs Unions will speed up the trade liberalization process if

$$\frac{\partial V_{iR}}{\partial R} > 0$$
$$\frac{\partial^2 V_{iR}}{\partial R \partial \tau_c} > 0 \qquad (42)$$

If the inequalities in 42 are reversed then Customs Unions will slow down the trade liberalization process. The second derivative is always positive, so I will concentrate on the first derivative. The exact functional forms of these derivatives appear in Appendix A.

5) Results and economic interpretation

The model above leads to the following results:

1) Customs Union formation could speed up or slow down trade liberalization depending on the parameters.

2) Customs Unions that happen later in the trade liberalization process are more likely to be beneficial to trade liberalization.

3) The higher the value of the discount factor δ the more likely it is that Customs Unions will speed up trade liberalization.

The first result is hardly surprising since it is a generalization of the same result in the stationary case. Observe that

$$\frac{\partial W_i(\tau_D^i, \tau_c^i, e=0)}{\partial R} < 0$$
$$\frac{\partial W_i(\tau_N^i, \tau_N^i, e=0)}{\partial R} > 0 \tag{43}$$

<u>Proposition 4:</u> For δ high enough, at least some Customs Unions will speed up trade liberalization.

<u>Proof:</u> The proof is trivial. Let δ=1 and e=0. $\partial V_{iR}/\partial R = \partial RW_i(\tau_N,\tau_N)/\partial R$. From 43 this is positive so Customs Unions in this case speed up trade liberalization. **QED**

Setting δ=0 and repeating the argument will prove that at least some Customs Unions will slow down trade liberalization.

The most intriguing result is 2. From 42[9], observe that the impact of Customs Unions depends on the size of the import competing sector, e. This impact therefore changes depending on the state of multilateral trade liberalization. To demonstrate the result, note that the first derivative in 42 is quadratic in e and convex. I will examine the two components of this equation separately. These components are $\partial RW_i(\tau_D,\tau_c)/\partial R$ and

[9] The functional forms are in Appendix A.

$\partial RW_i(\tau_N,\tau_N)/\partial R$. Also recall that there is an upper limit to e defined by equation 27. This ensures that the relevant range for e is the decreasing part of both these functions. Figure 5 demonstrates the shape of these two functions. δ determines the weights placed on each of these two function. If δ is high the effect on the latter dominates. Otherwise the effect on the former dominates. Figure 5 demonstrates that as e decreases both functions increase making the weighted average more positive. From 42 this means that as e decreases it becomes more likely that Customs Unions will speed up trade liberalization.

The intuition behind this unique result is as follows. The only effect of Customs unions is through the market power effect. The market power effect increases both the deviating and the Nash tariffs. In the Nash tariff case that always decreases Nash welfare and in the deviating case it increases deviating welfare. This increases both the cost and the benefit of deviating.

The key question is by how much does the market power effect increase these tariffs. When e is high recall from earlier discussion that domestic prices of import goods are low and that the elasticity of demand is high. In this case the cost of increasing tariffs is very high because it will push prices up. This is demonstrated in figure 2. Therefore, in this case the increase in the tariffs due to the market power effect will be small. The opposite is true for small e. Therefore the effect of market power is much bigger when e is low.

Also the Nash welfare is much more sensitive to changes in tariffs than the deviating welfare. The reason behind this is that changing the Nash tariffs will change all the tariffs for all regions affecting all sectors. This is due to the tariff complementarity effect in 9. Notice that if Nash tariffs increase that will increase the tariffs of all other domestic regions which makes it advantageous for the region in question to increase its tariff further. In contrast to that the deviating tariff only affects prices in the deviating country leaving other sectors untouched. There is no tariff complementarity here since all other regions cooperate and therefore leave their tariffs unchanged. The market power effect is therefore more effective in the Nash case.

As time goes on and e decreases, the market power effect has a bigger impact on the benefit and the cost of deviating. This impact is higher for the cost side because that is more sensitive to tariff changes because of the tariff complementarity effect. Therefore as time goes on more cooperation is more likely.

The final result is again a generalization of the result from the stationary case. The intuition behind it is that as δ increases the future becomes more important to the regions. Since the increase in the benefit of deviating because of the market power effect occurs right away and the increase in the cost occurs in the future, the higher the value of δ the more dominant the increase in cost becomes. This increases the chances of more cooperation in the form of lower cooperative tariffs.

The Implications for Article XXIV

These results shed some light on Article XXIV of the WTO. This article encourages all Customs Unions by granting them exceptions from the Most Favored Nation clause. This implies that the WTO view is that all Customs Unions speed up trade liberalization. That is entirely possible within the model above. If we start from a point where the import competing sector is small enough and the discount rate high enough, then Customs Unions can be beneficial even in the first GATT round.

The other implication of the result is that the WTO might be better off with dynamic incentives. Since the impact of Customs Unions is dynamic, the WTO should provide higher incentives for more effective Customs Unions. In other words, the WTO should encourage Customs Unions in later rounds more than in earlier rounds. That, however, might not be politically feasible.

6. Conclusion

I have presented a dynamic model that explicitly considers the effects of Customs Union formation on the speed of trade liberalization. The main result of the model is that not all Customs Unions are created equal. Customs Unions in later rounds of trade liberalization are more likely to speed up the process than those in earlier rounds. The literature has so far ignored the possibility mainly because the analysis was based on static or stationary models. In the context of a non-stationary model the timing of Customs Unions becomes crucial.

The model also confirms Bagwell and Staiger's result that a high discount factor would tend to make Customs Unions more likely to speed up trade liberalization. Also, the model demonstrates that for some parameters Customs Unions will be beneficial to trade liberalization. Finally, the static and stationary dynamic versions of the model provide similar results as other papers with such models. The only difference is that the paper highlights the false interpretation that increases in Nash tariffs mean a slowing down of trade liberalization. In fact the opposite is true in a dynamic environment where Nash tariffs are the punishments.

Article XXIV is compatible with the model in the sense that it is entirely possible that all Customs Unions are beneficial to trade liberalization. That will happen when the import competing sector is small enough and the discount factor high enough even in the first round. However, the fact that Customs Unions are more beneficial in later rounds suggests that the WTO should encourage those more, if that is politically feasible.

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Appendix A

$$\frac{\partial RW_i(\tau_N^i,\tau_N^i)}{\partial R}=\frac{\beta(E-e)^2}{(2R+1)^3}$$

$$\frac{\partial RW_i(\tau_D^i,\tau_c^i)}{\partial R}=\frac{\partial\tau_D^i}{\partial R}[\frac{E-e-4\beta(R-1)\tau_c^i-\beta\tau_D^i(4R-1)}{4}]-\beta\tau_D^i\tau_c^i$$

$$\frac{\partial RW_i(\tau_D^i,\tau_c^i)}{\partial R\partial\tau_c^i}=\beta\tau_D^i+\beta(R-1)\frac{\partial\tau_D^i}{\partial R}(1-4\beta)-\frac{4\beta^2(R-1)^2\tau_c^i}{4R-1}+\frac{3\beta}{(4R-1)^2}[E-e-4\beta(R-1)\tau_c^i]$$

$$\frac{\partial RW_i(\tau_N^i,\tau_N^i)}{\partial R\partial\tau_c^i}=0$$

Appendix B

Customs Unions as a two stage process

In this case, I will assume that Customs Unions formation is a more complicated process. Assume that in period t regions become aware that some Customs Unions are politically feasible. From that point on the probability that Customs Unions will happen next period is λ. This probability is constant through time. As above Customs Unions happen because of reasons exogenous to the model. Customs Unions can only happen once and the number of home and foreign regions remains symmetric before and after the Customs Union.

This new game can now be divided into 3 stages. In stage 1 regions are unaware of the possibility of Customs Union formation. There are R_0 of each type of regions and these regions play the dynamic tariff game described in the body of the paper. In the second stage there are still R_0 regions of each type but regions now anticipate the possibility of future Customs Union formation. In stage 3 Customs Unions happen and there are now only R_1 regions of each type. Regions now play the infinitely repeated dynamic game described in the paper but with a fewer number of regions.

In all three stages regions pick the most cooperative tariff that balances the cost of deviating with the benefit of deviating. For stage 3 that will be given by equation 37 with $R=R_1$. For stage 1 it will be given by 37 again but in this case $R=R_0$. These will define two series of tariffs $\{\tau_{ct}^1\}$ and $\{\tau_{ct}^3\}$ each having the properties described in the paper. In other words, these two sequences are both decreasing with time.

Now consider the tariff setting process in stage 2. Let B_{t*} ($t^*>t$) be the discounted welfare from cooperating from period t^*+1 onwards. The equilibrium tariffs for this stage will be defined by

$$W_i(\tau_D^i, \tau_c^i, e_i(\tau_c^{i-1})) - W_i(\tau_c^i, \tau_c^i) \le B_{it*} - \frac{\delta}{1-\delta} W_i(\tau_N^i, \tau_N^i, e_i(\tau_c^{i-1})))$$

(44)

Notice that this is the same as the relevant equation in stage 1 except from B_{t*}. To characterize the sequence of tariffs in this stage $\{\tau_{ct}^2\}$ we need to consider two separate cases.

In the first case assume that at the time we switch from stage 1 to stage 2 Customs Unions are beneficial to the trade liberalization process. In other words after this time the cooperative tariffs with R_1 regions are less than those with R_0 regions. This means that there is a positive probability that welfare from cooperation will increase in the future. Since B_{t*} is the weighted discounted cooperative welfare in the future, it will be higher than that in stage 1. This implies that the tariff sequence in stage 2 will be lower than that in stage 1. Another way of saying this is that there will be a fall in tariffs over and above that implied by the tariff liberalization process as we move from stage 1 to stage 2.

The next thing to consider is what happens as we move from stage 2 to stage 3. Using the fact that the only difference between 44 and the equation for stage 1 is B_{t*} we can say something about the change from stage 2 to stage 3. By assumption we know that 37 with $R=R_0$ (stage 1) gives higher cooperative tariffs than 37 with $R=R_1$ (stage 3). Now compare B_{t*} with the cooperative welfare in stage 3. B_{t*} is higher than the welfare in stage 1 but lower than that in stage 3. The change in the cost of deviating as we move from stage 2 to stage 3 is therefore less than the change in moving from stage 1 to stage 3 directly. Since everything else is the same we can conclude that tariffs could go either up or down as we move from stage 2 to stage 3.

Figure 7 demonstrates the result. So tariffs in stage 2 can either fall to an intermediate level between those in stages 1 and 3 or alternatively fall below those in stage 3. Which one of the two cases actually happens will depend on how long stage 2 is. Recall that as time goes on and we move to later stages of trade liberalization the increase in the cost of deviating increases making it more and more likely that tariffs will drop as we move from stage 2 to stage 3. This result also depends on the fact that the weights on B_{t*} do not change with time. This is because the probability of Customs Union formation is independent of time. The reasoning is exactly analogous to that in the simpler Customs Union formation described above. In this case Customs Unions will definitely speed up the trade liberalization process.

A higher discount factor δ will have two effects. The first is that it will increase the weight of future cooperative welfare in B_{t*}. This means B_{t*} will be closer to the cooperative welfare in stage 3 and further away from the cooperative welfare in stage 1. This means that the fall in tariffs as we move from stage 1 to stage 2 will be much bigger. The second effect will be on change from stage 2 to stage 3. Since B_{t*} is closer to stage 3 cooperative tariffs, by the reasoning in the paragraph above, it will be more likely that tariffs will go up as we move from stage 2 to stage 3. The time in stage 2 required to reverse that will however be shorter since future decreases in the autarky welfare become more important.[10]

[10] The reasoning here is identical to the reasoning in the section on Customs Unions as a surprise.

Now consider the case where τ_{ct}^1 is lower than τ_{ct}^3 at the time we switch from stage 1 to stage 2. This case is a lot more complicated. In this case we can not claim that tariffs in stage 3 are higher than tariffs in stage 1. This is because the situation could be reversed by the time we move into stage 3. In other words, stage 3 happens much later than the end of stage 1. As shown in the simpler Customs Union process above this might mean that in this later time period stage 3 tariffs are less than stage 1 tariffs. Because of this possibility we can not say if future cooperative welfare will go up or down so we can not say anything about B_{t*}. All conceivable combinations of tariffs are possible including one where tariffs jump up as we move from stage 1 to stage 2 only to jump further up as we move from stage 2 to stage 3. In this case λ must be very high so that the duration of stage 2 is small enough not to reverse the relationship between stage 1 and stage 3 tariffs. This extreme case is illustrated in figure 8. In this case Customs Unions will slow down the trade liberalization process.

Therefore, the later stage1 ends the more likely it is that we are dealing with the former case i.e. $\tau_{ct}^1 > \tau_{ct}^3$. This follows straight from the results in the simpler Customs Union formation process, which compares these two tariffs directly. Recall that the result there was that Customs Unions that happen later are more likely to lower tariffs. This implies that the if Customs Unions become feasible later rather than earlier regions are going to experience a drop in tariffs as they move from stage 1 to stage 2. Also, the longer stage 2 lasts the more likely it is that regions will experience a further drop in tariffs as we move from stage 2 to stage 3. In addition, the higher the discount rate δ is the bigger the more likely it is that there is going to be a drop in tariffs after stage 1 and the higher that drop will be. The former of these two effects of the discount factor was established in the case with the simpler Customs Union formation process. So the results of the paper are generalized for this more complicated Customs Union formation process.

Figure 1

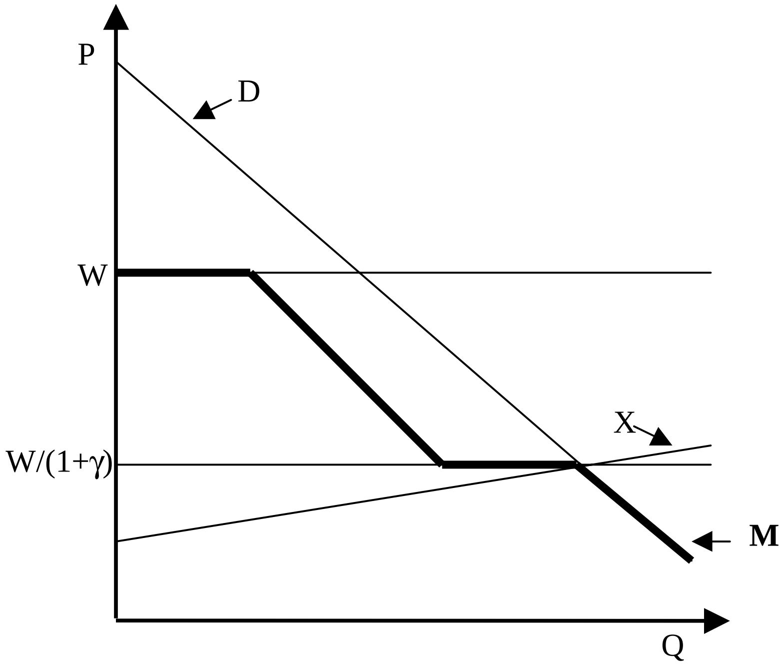


Figure 2

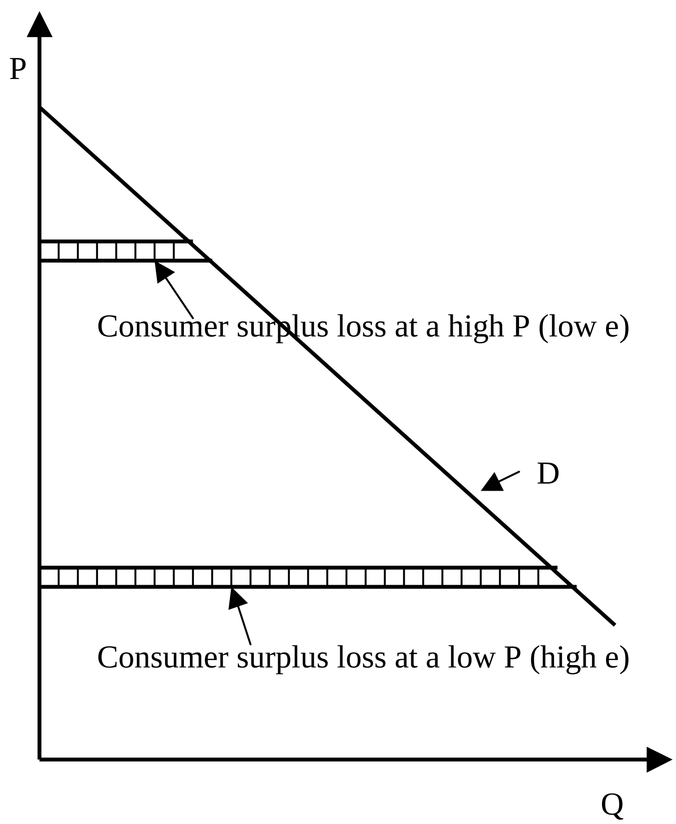


Figure 3

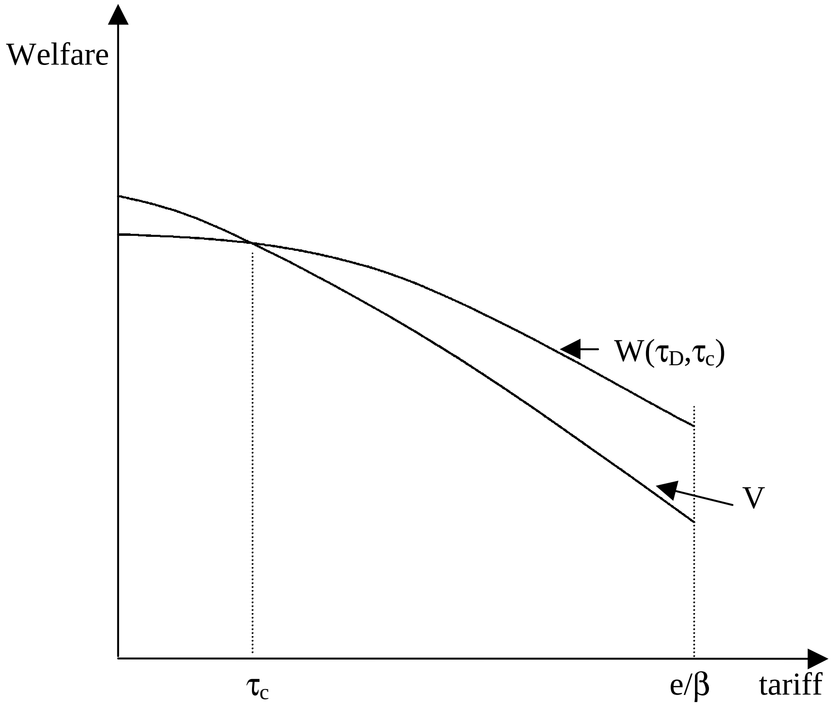


Figure 4

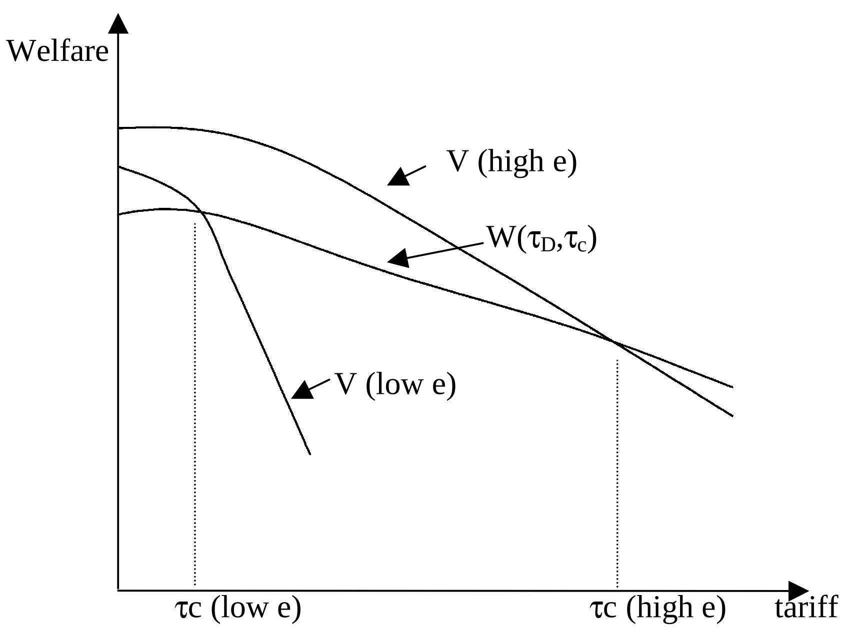


Figure 5

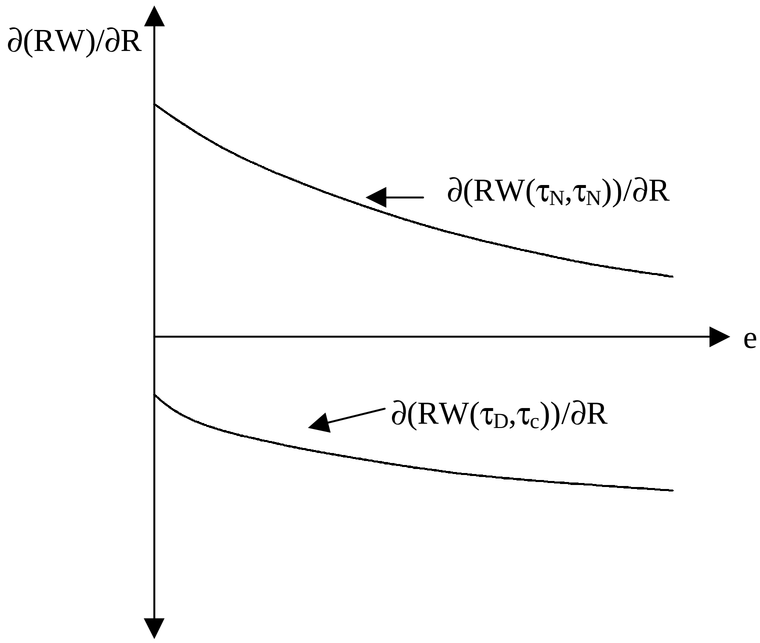


Figure 6

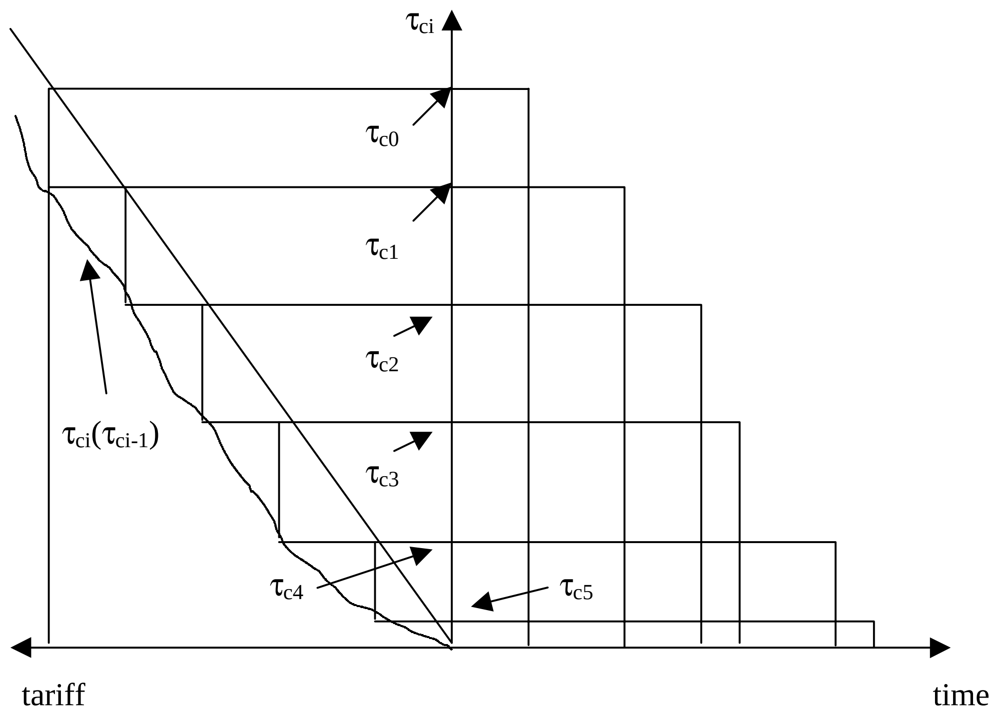


Figure 7

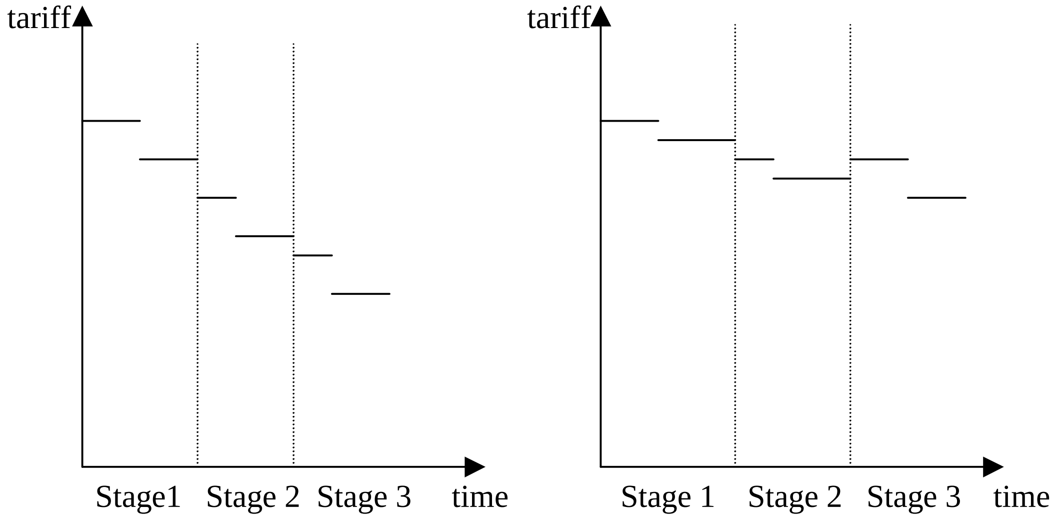
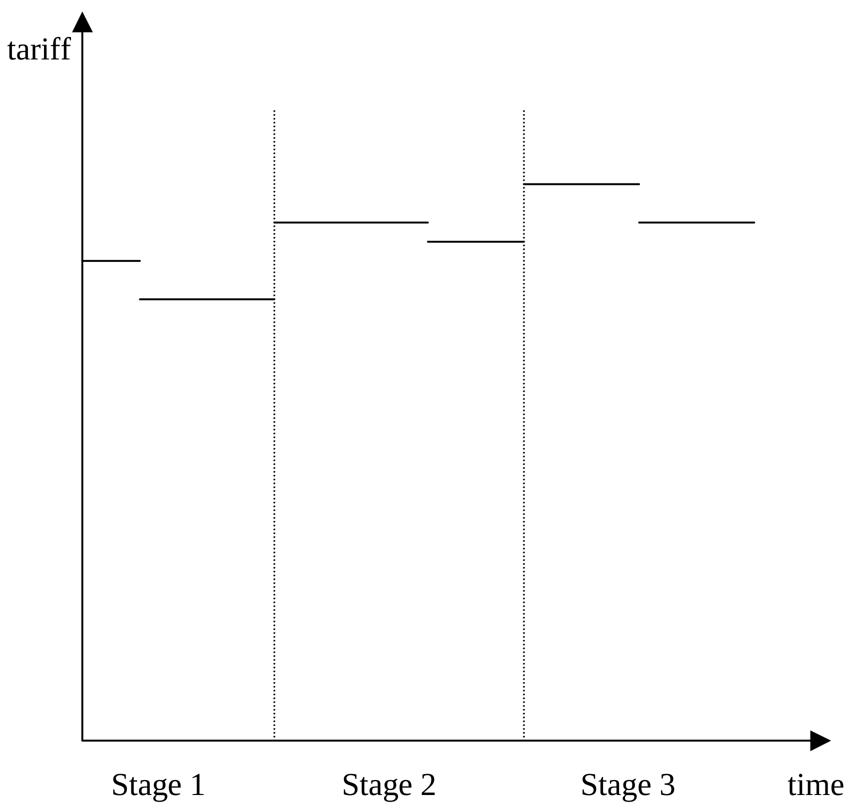


Figure 8



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