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COMMON MARKETS AND TRADE LIBERALIZATION

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Common Markets and Trade Liberalization

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Abstract

This paper expands on previous work by the author on the effects of regionalism on the speed of trade liberalization. Trade liberalization is essentially a cooperative non-stationary dynamic process and it is on the basis of such a model that the impact of regionalism needs to be examined. In doing so I am able to examine how the impact of Common Markets on trade liberalization differs with time. This has been ignored by the literature up to now. This paper uses a completely different trade liberalization process from the earlier paper and confirms and expands the previous results. The trade liberalization model used is adapted from Devereux (1997). Common Markets will have two effects. They will cause a one-time shock on immediate tariffs and will change the rate of decline of tariffs after that. The results are that Common Markets that happen late in the trade liberalization process are more likely to lead to a decline in immediate tariffs. Common Markets will also increase the rate of decline of tariffs after their formation.

1: Introduction

The effects of Common Markets and other regional trade agreements on the process of trade liberalization have been attracting lots of discussion in the 1990's. The WTO seems to be of the view that Common Markets are a stepping stone towards global free trade speeding up the trade liberalization process. This is evident by Article XXIV that grants exceptions to the Most Favored Nation clause to regional trade agreements.

The economic literature on the topic is extensive and divided on the issue. Some, most notably Bhagwati, have been arguing that regional trade agreements only serve to slow down the process of trade liberalization by increasing tariffs. His views are almost always based on static models of tariff determination. In short, most static models show that regionalism increases Nash equilibrium tariffs. Bhagwati and others interpret this to imply that the trade liberalization process will slow down.

Others use more complicated static or stationary trade liberalization models to show cases where regionalism can under certain circumstances lower tariffs at least in the short run. These include Krugman (1991) and Bagwell and Staiger (1997)[1]. However none of these papers is actually studying the issue in its proper context. The trade liberalization process as represented by the WTO is essentially a non-stationary dynamic model of cooperation between countries. It is in the context of such a trade liberalization model that the effect of regionalism needs to be examined.

This is not just a methodological point and it will have a huge impact on the results. First of all, the impact of regionalism will vary with time. The only way to investigate that is to use a non-stationary dynamic model. It is precisely this issue that

[1] Bagwell & Staiger use stationary trade liberalization models but include non-stationarities in their regionalism process.

this paper is addressing. A more basic point is that the interpretation of an increase in Nash tariffs will be the exact opposite of that proposed by Bhagwati. In such a model Nash tariffs are the punishment tariffs and an increase in these will make punishments more severe and cooperation more likely.

This paper will expand on previous work by the author in this area. In an earlier paper a non-stationary dynamic model of trade liberalization by Staiger was first adapted to allow for more than two countries and then used to study the issue. The main results were that Customs Unions are more likely to lead to a decrease in immediate tariffs if they happen later rather than earlier in that process. Also, a high discount factor makes it more likely that Customs Unions are beneficial to trade liberalization (a result that first appeared in Bagwell and Staiger). The model shows that not all Customs Unions are created equal. Some will be beneficial and others will not, depending on the parameters of the model and the timing of Customs Unions.

This paper repeats a similar exercise using a completely different trade liberalization model. This new trade liberalization model appears in Devereux (1997). The first part of the paper expands the Devereux model to allow for more than two countries. The second part introduces Common Market formation and examines its impact on cooperative tariffs. The use of Common Markets as opposed to any other form of regionalism has to do with the specifics of the trade liberalization model used.

Common Markets will have two effects on the trade liberalization process. The first is that they will cause a one-time shock on immediate tariffs. The second is that they will change the rate of decline of tariffs after their formation.

Human capital accumulation is the driving force behind trade liberalization in this model. In using this paper I am examining the market power effect created by faster human capital accumulation after regionalism. This is a direct consequence of faster technology transfer after regionalism, an idea formally examined in Rivera-Batiz and Romer (1991). The results of the previous paper are confirmed in this model. In addition comparative statics are performed to identify how the results change with changes in the parameters. Finally the change in the rate of decline of tariffs after the Common Markets is investigated.

Section 2 will present the basic model and section 3 will derive the competitive equilibrium of the model given some tariffs. Section 4 sets up and solves for the trade liberalization process. These three sections borrow heavily from Devereux's work. They basically expand Devereux's model to allow for a large number of regions. Common Markets are introduced in section 5. Two distinct Common Market formation processes are considered. In the first Common Markets are a surprise to everyone. In the second case it becomes politically feasible after a time t for some Common Markets to be formed. After that period the probability that Common Markets are formed next period is λ. The results are identical in both cases. Section 6 summarizes the results and examines the economic intuition behind these results. Section 7 presents the conclusions.

2: The model

There are two types of regions in the World, home and foreign. These regions are Common Markets so tariff decisions are taken at the regional level. In this model, Common Markets behave as if they were countries. An asterisk denotes foreign regions.

There are R such regions of each type in the World. There are only two goods in the World denoted by the subscripts 1 and 2. There is a measure 1/R consumers and 1/R workers in each region. The utility function of a representative consumer is given by

$$U_t = c_{1t} c_{2t}$$

$$U_t^* = c_{1t}^* c_{2t}^* \tag{1}$$

This implies that the total consumer utility in each region is

$$U_t = \frac{1}{R} c_{1t} c_{2t}$$
$$U_t^* = \frac{1}{R} c_{1t}^* c_{2t}^* \tag{2}$$

Since regions of the same type are identical there is no trade between them in symmetric equilibria. However, consumers will trade with the residents of regions of the other type. I will assume that there are no international capital markets.

The production side of the economy is given by the following Ricardian production technologies

$$y_{1t} = a_t l_{1t}$$
$$y_{2t} = b_t l_{2t}$$
$$l_{1t} + l_{2t} = \frac{1}{R} \tag{3}$$

for home regions and

$$y_{1t}^* = b_t l_{1t}^*$$
$$y_{2t}^* = a_t l_{2t}^*$$
$$l_{1t}^* + l_{2t}^* = \frac{1}{R} \qquad (4)$$

for foreign regions. y_{it} is the home production of good i and l_{it} is the labor allocated to the production of that good.

Labor productivity changes through time depending on the current state of sector-specific technical knowledge. This technical knowledge accrues through two channels. The first is internal to the region and it accrues because of domestic production of the good and it represents learning-by-doing. In addition to that domestic trade in ideas[2] also increases this sector-specific human capital. The second channel is knowledge spillovers from other regions because of international trade in ideas, reverse engineering (whenever the two regions trade) or sharing of information through trade shows, e-mail, site visits etc. The state of technical knowledge in each sector is characterized by

$$a_t = \alpha h_{at}; h_{at} = h_{at-1}(1 + \sigma l_{1t-1} + \sigma\theta L_{1t-1})$$
$$b_t = \beta h_{bt}; h_{bt} = h_{bt-1}(1 + \sigma l_{2t-1} + \sigma\theta L_{2t-1})$$
$$a_t^* = \alpha h_{at}^*; h_{at}^* = h_{at-1}^*(1 + \sigma l_{2t-1}^* + \sigma\theta L_{2t-1})$$
$$b_t^* = \beta h_{bt}^*; h_{bt}^* = h_{bt-1}^*(1 + \sigma l_{1t-1}^* + \sigma\theta L_{1t-1}) \qquad (5)$$

where h_{it} denotes the sector-specific human capital accumulated in industry i at time t, for i=a,b. a and b denote the corresponding stocks of human capital. L_{it} represents the production of good i by all other regions, home and foreign. Industry a represents the industry in which the region has a comparative advantage. Without loss of generality, let that industry produce good 1 in home regions and good 2 in foreign regions.

Human capital accumulation depends on the share of labor devoted to the production of each good. The more a region specializes in that good the higher the growth rate of human capital will be in that sector. The parameter σ determines how fast human capital can grow. Human capital also accumulates as a result of international spillovers within the specific sector. The parameter θ determines how fast human capital grows because of international spillovers. A maintained assumption is that $\theta \in (0,1)$. Intuitively this implies that internal spillovers increase human capital faster than external ones. The flow of information is simply much easier within a region than between regions. Rivera-Batiz and Romer provide an explanation why this might be so. They consider trade in ideas and suggest that national borders restrict such trade. Another justification is that reverse engineering is always possible within a region because goods are available in the market, but is not always possible between regions since regions do not exchange the same good. Also, there are lots more trade shows within the region than between regions. This assumption is going to prove crucial to the results of the paper. Basically, if $\theta=1$ there will be no growth gains from trade. I will postpone the discussion of its importance until the next section where I discuss the gains from trade.

The game in every period is then played as follows: First the workers allocate themselves between industries given anticipated wage rates. Then governments take these labor allocations as given and choose their optimal tariffs. Finally, firms maximize their profits given these labor allocations and tariffs. At the end of the period, goods markets clear determining prices and wage rates. All agents have perfectly rational expectations so their anticipated wages coincide with the actual wage rates at the end of

[2] This trade in ideas is not modeled here. For a formal treatment of this trade see Rivera-Batiz and Romer

the period. The objective of the governments is to maximize the discounted utility of their citizens given a discount rate $\delta \in [0,1]$.

3: Competitive equilibrium for given tariff levels

Before setting up the dynamic model, I derive the competitive equilibrium of the one stage game for given tariffs. I will consider three cases: autarky (prohibitive tariffs), free trade (zero tariffs) and positive but non-prohibitive tariffs. The following two conditions are imposed on the parameters:

$$\delta(1+\sigma)^2 < 1 \tag{6}$$

This ensures that under all possible cases welfare is positive and finite. This includes any of the trading regimes above and any number of regions.

$$h_{a0} = h_{a0}^*; h_{b0} = h_{b0}^*$$
$$\frac{\beta h_{b0}}{\alpha h_{a0}} < 1 \tag{7}$$

These conditions impose symmetry between home and foreign regions and ensure that home regions have a comparative advantage in good 1 and foreign regions in good 2.

Autarky

Consider a time period t. In autarky there is no trade between regions. This implies that every region is producing both goods. Consumer utility maximization implies

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(1991).

$$P_t^A c_{1t} = c_{2t} \tag{8}$$

where good 2 is used as the numeraire good and P_t^A is the relative price of good 1. Since both goods are produced in every region, real wages between the two sectors must be equal. This implies that

$$P_t^A = \frac{b_t}{a_t} \tag{9}$$

Market clearing ensures that in any home region

$$\begin{aligned} c_{1t} &= a_t l_{1t} \\ c_{2t} &= b_t l_{2t} \end{aligned} \tag{10}$$

Combining 3, 8, 9 and 10 we get

$$l_{1t} = l_{2t} = \frac{1}{2R} \tag{11}$$

10, 11 and 2 give the per period welfare of each region as:

$$U_t = \frac{1}{4R^3} a_t b_t \tag{12}$$

From 5 and 11 we can derive the growth rate of output in each sector as $1+(\sigma/2R)+\sigma\theta(2R-1)/(2R)$. This means that the growth rate of welfare is:

$$(1 + \frac{\sigma}{2R} + \sigma\theta \frac{2R-1}{2R})^2 \tag{13}$$

Finally, the sum of the discounted welfare as viewed from period 0 is:

$$V^A = \frac{\frac{1}{4R^3}\alpha\beta h_{a0} h_{b0}}{1-\delta(1+\frac{\sigma}{2R}+\sigma\theta\frac{2R-1}{2R})^2} \tag{14}$$

Free trade

In this case the regions will specialize in their comparative advantage good and trade with regions of the other type for the other good. In any period t, World output of each good is a_t. Symmetry implies that the relative price of good 1 will be 1 and that each region consumes $a_t/2R$ of each good. The per period welfare of each region is then:

$$U_t = \frac{1}{4R^3} a_t^{\,2} \tag{15}$$

The sum of the discounted welfare as viewed from period 0 is:

$$V^F = \frac{\frac{1}{4R^3}\alpha^2 h_{a0}^{\,2}}{1-\delta(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})^2} \tag{16}$$

Comparing 14 and 16 one can see the gains from trade. These can be divided into static and dynamic gains from trade. Comparing the numerator in the two expressions one can see the static gains from trade. In the free trade case regions specialize in the first period so they do not waste resources on the low productivity sector.

Comparing the denominators one can see the dynamic gains from trade. For $\theta<1$, $(1+\sigma/R+\sigma\theta(R-1)/R)^2 > (1+\sigma/2R+\sigma\theta(2R-1)/R)^2$. In other words, the growth rate of output under free trade is higher than that under autarky. The intuition behind this is that by producing more of their comparative advantage good at home, regions accumulate technical knowledge faster. This in turn leads to higher productivity growth. These

dynamic gains from trade are going to be driving the trade liberalization process and the other results of the paper in later sections.

If θ=1 the two growth rates are the same and there are no dynamic gains from trade. This is because no matter where production takes place all regions get the full benefit of it, whether they specialize or not. In that case, opening up trade only leads to static gains. These are a one-time level effect that is shown later on to affect the benefit and the cost of deviating proportionately and therefore do not affect equilibrium cooperative tariffs.

Competitive Equilibrium with positive but non-prohibitive tariffs

In this section I will compute the competitive equilibrium for given labor allocations and tariffs. Define τ as the gross tariff rate. This means that if tariffs are zero, τ will be equal to one. Also, assume that the government of each region distributes tariff revenues to consumers as lump sum transfers. Let T_t be these transfers for a home region. Also let y_i be the production of good i. Then the transfers are

$$T_t = (\tau_t - 1)(c_{2t} - y_{2t}) \tag{17}$$

Consumers are therefore faced with the following budget constraint

$$P_t c_{1t} + \tau_t c_{2t} = P_t y_{1t} + \tau_t y_{2t} + T_t \tag{18}$$

Consumer utility maximization implies

$$\frac{P_t}{\tau_t} c_{it} = c_{2t} \tag{19}$$

From 18 and 19 we get

$$c_{1t} = \frac{\tau_t}{(1+\tau_t)P_t}(P_t y_{1t} + y_{2t})$$
$$c_{2t} = \frac{1}{(1+\tau_t)}(P_t y_{1t} + y_{2t})$$
$$c_{1t}^* = \frac{1}{(1+\tau_t^*)P_t}(P_t y_{1t}^* + y_{2t}^*)$$
$$c_{2t}^* = \frac{\tau_t^*}{(1+\tau_t^*)}(P_t y_{1t}^* + y_{2t}^*) \qquad (20)$$

To completely characterize the competitive equilibrium we need to solve for P_t and labor allocations. Market clearing implies that the sum of production of each good must be equal to the sum of the consumption for the same good. Using market clearing and 20 we get

$$P_t = \frac{\sum_j \frac{\tau_{tj}}{1+\tau_{tj}} y_{2tj} + \sum_l \frac{1}{1+\tau_{tl}^*} y_{2tl}^*}{\sum_j \frac{1}{1+\tau_{tj}} y_{1tj} + \sum_l \frac{\tau_{tl}^*}{1+\tau_{tl}^*} y_{2tl}^*} \qquad (21)$$

Finally, the following inequalities describe the labor allocation:

$$(i) P_t a_t > b_t \tau_t \Rightarrow l_{1t} = \frac{1}{R}; (ii) P_t a_t = b_t \tau_t \Rightarrow 0 \le l_{1t} \le \frac{1}{R}; (iii) P_t a_t < b_t \tau_t \Rightarrow l_{1t} = 0$$

$$(iv) P_t b_t \tau_t^* > a_t \Rightarrow l_{2t}^* = \frac{1}{R}; (v) P_t b_t \tau_t^* = a_t \Rightarrow 0 \le l_{2t}^* \le \frac{1}{R}; (vi) P_t b_t \tau_t^* < a_t \Rightarrow l_{2t}^* = 0 \qquad (22)$$

The inequalities in 22 will determine the tariff ranges for which specialization is possible or in other words what tariffs will allow each region to specialize in its comparative advantage good. A competitive equilibrium is $\{c_{it}, c_{it}^*, P_t, l_{it}, l_{it}^*, \tau_t, \tau_t^*\}_t$ for t=1...∞ that

satisfies consumer utility maximization, government budget constraints, market clearing and labor market equilibrium conditions or in other words 20, 21 and 22.

Figure 1 illustrates this simple Ricardian setup. The Production Possibility Frontiers (PPF's) for each type of region are linear and trade will be advantageous if the domestic price of good 1 is more than b_t/a_t. In that case, every region will completely specialize in their comparative advantage good. Otherwise there will be no trade and each region will be in autarky.

4: The trade liberalization process

In this section, I will model tariff determination as a repeated game between governments. Recall that governments take labor allocations as given in every period and then make their tariff decisions.

Proposition 1: Governments are faced with an identical stage game every period that differs only in the value of the state variable. The state variable is of course the value of specialist human capital.

Proof: Governments make their tariff decisions after workers decide on labor allocations. From 5 observe that current tariff choices do not affect the value of specialist human capital. Tariff decisions are therefore independent of the state variable. From 22 future labor allocations depend only on future tariffs but not current tariffs. Therefore, tariff decisions in period t only affect variables in that period. Therefore, governments are faced with an identical stage game that differs only in the value of the state variable.

QED

Having established that, I will now allow regions to coordinate their tariff decisions, subject to the condition that any such agreement is self-enforcing. This can be thought of as a multilateral trade liberalization process facilitated by an international organization such as the World Trade Organization (WTO). Strategies in this game are history dependent. In other words, regions cooperate until there is a deviation. If any region deviates then regions switch to a punishment tariff forever. Let τ_{ct} be the cooperative tariff in period t and τ_{Nt} be the punishment tariff. Then every region follows the following strategy:

$$\tau_{t+1} = \begin{cases} \tau_{ct+1} & \text{if everybody cooperated for all periods up to t} \\ \tau_{Nt+1} & \text{otherwise} \end{cases}$$

The solution to this game must satisfy the following conditions:

1) Equilibrium is symmetric and subgame perfect. (All regions foreign and domestic choose the same tariff).

2) If a deviation occurs then all regions revert to autarky i.e. impose prohibitive tariffs.

3) From the equilibria satisfying the above, pick the most cooperative one. That will be the one with the lowest cooperative tariffs.

As stated above the punishment tariffs are prohibitive tariffs. For this solution to be subgame perfect prohibitive tariffs must be a Nash equilibrium.

Proposition 2: Prohibitive tariffs are a Nash Equilibrium of the stage game.

Proof: Let all regions impose prohibitive tariffs on region X. That means that X can not sell any goods to any region. Other regions will not trade with X because X can give nothing in return. Therefore, no matter what tariff X imposes there is going to be no trade. In a weak sense imposing prohibitive tariffs is therefore a best response. Since regions are symmetric, autarky is a Nash Equilibrium. **QED**

Proposition 3: Autarky is the maximum punishment that regions can impose on deviators in a subgame perfect equilibrium.

Proof: Assume not. Then there exists a Nash equilibrium that yields a lower welfare than autarky. If that is the case any region will be better off by unilaterally imposing prohibitive tariffs. That means that the previous strategy wasn't a best response. That equilibrium is therefore not a Nash Equilibrium contradicting the previous statement. **QED**

Propositions 2 and 3 show that autarky is the maximum punishment that can be imposed in a subgame perfect equilibrium and will therefore yield the highest level of cooperation.

Also, note that from 21, P_t=1 for all symmetric equilibria. From 22 observe that tariffs that do not allow specialization are unique ($\tau_t = a_t/b_t$). These tariffs will be prohibitive and constitute Nash equilibria for the stage game as illustrated by Figure 1. This tariff sequence is, therefore, a subgame perfect equilibrium of the game. I will concentrate on cooperative tariffs lower than these. These cooperative tariffs lead to complete specialization in each region's comparative advantage good and trade. This is illustrated in Figure 1 and is derived from equation 22.

Given that all regions cooperate and specialize in the production of their comparative advantage good, the period welfare from cooperating is:

$$U_{ct} = \frac{\tau_c}{(1+\tau_c)^2}\frac{a_t}{R^3} \tag{23}$$

Now assume that all regions are cooperating while region X wants to deviate by choosing τ_D. Specialization implies that the relative price of good 1 is:

$$P_t = \frac{R(1+\tau_{Dt})}{(1+\tau_{ct})+(R-1)(1+\tau_{Dt})} \tag{24}$$

The period welfare from deviating is:

$$U_{Dt} = \frac{R\tau_{Dt}}{(1+\tau_{Dt})(1+\tau_{ct})+(R-1)(1+\tau_{Dt})^2}\frac{a_t^2}{R^3} \tag{25}$$

Maximizing 25 with respect to τ_{Dt} we get that τ_{Dt} is

$$\tau_{Dt} = \frac{\sqrt{\tau_{ct}+R}}{\sqrt{R-1}} \tag{26}$$

The benefit from deviating is therefore:

$$U_{Dt} - U_{ct} = \frac{\tau_{Dt}R}{(1+\tau_{Dt})(1+\tau_{ct})+(R-1)(1+\tau_{Dt})^2}\frac{a_t^2}{R^3} - \frac{\tau_{ct}}{(1+\tau_{ct})^2}\frac{a_t^2}{R^3} \tag{27}$$

The benefit from deviating needs to be decreasing in τ_{ct}. This is essential if the results are going to make sense. That will make sure that an increase in the cost of deviating will result in a decrease in equilibrium tariffs (which will increase the benefit of deviating by an equal amount). The following condition ensures that

$$\tau_{ct} \leq \arg\min_{\tau_{ct}}[U_{dt} - U_{ct}] \tag{28}$$

for all time periods t.

The discounted welfare from cooperating from period t+1 forever as viewed from period t is:

$$U_{coop} = \delta \frac{a_t^{\,2}}{R^3} \sum_{i=0}^{\infty} (\delta(1 + \frac{\sigma}{R} + \sigma\theta \frac{R-1}{R})^2)^i \frac{\tau_{ct+1+i}}{(1+\tau_{ct+1+i})^2} \tag{29}$$

The discounted welfare from autarky from period t+1 to infinity as viewed from period t is:

$$U_p = \frac{1}{4R^3} \frac{\delta a_t b_t (1 + \frac{\sigma}{R} + \sigma\theta \frac{R-1}{R})(1+\sigma\theta)}{1 - \delta(1 + \frac{\sigma}{2R} + \sigma\theta \frac{2R-1}{2R})^2} \tag{30}$$

The cost of deviating will be the difference between the future welfare lost due to cooperation and the future autarky welfare. This is:

$$U_{coop} - U_p = \delta \frac{a_t^{\,2}}{R^3} \sum_{i=0}^{\infty} (\delta(1 + \frac{\sigma}{R} + \sigma\theta \frac{R-1}{R})^2)^i \frac{\tau_{ct+1+i}}{(1+\tau_{ct+1+i})^2} - \frac{1}{4R^3} \frac{\delta a_t b_t (1 + \frac{\sigma}{R} + \sigma\theta \frac{R-1}{R})(1+\sigma\theta)}{1 - \delta(1 + \frac{\sigma}{2R} + \sigma\theta \frac{2R-1}{2R})^2} \tag{31}$$

The subgame perfect equilibrium of the game will be the one that just balances the cost of deviating with its benefit. In other words, the cooperative tariffs will be those that make 27 and 31 equal. Setting 27 equal to 31 and simplifying we get:

$$\frac{\tau_{Dt}R}{(1+\tau_{Dt})(1+\tau_{ct})+(R-1)(1+\tau_{Dt})^2}-\frac{\tau_{ct}}{(1+\tau_{ct})^2}=$$

$$\delta\sum_{i=0}^{\infty}(\delta(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})^2)^i\frac{\tau_{ct+1+i}}{(1+\tau_{ct+1+i})^2}-\frac{1}{4}\frac{\beta h_{b0}}{\alpha h_{a0}}(\frac{(1+\sigma\theta)}{(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})})^t\frac{\delta(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})(1+\sigma\theta)}{1-\delta(1+\frac{\sigma}{2R}+\sigma\theta\frac{2R-1}{2R})^2} \quad (32)$$

Let V_{Dt} be the left-hand side of 32 or in other words the net benefit of deviating. Also let V_c be the right-hand side of 32 or the net cost of deviating. In addition let the second term of V_c be U_{ps}. U_{ps} is the welfare from autarky, U_p divided by a_t^2/R^3.

Proposition 4: U_{ps} is decreasing in t. As t goes to infinity U_{ps} goes to zero.

Proof: Recall that $\theta<1$. Then observe that $1+\sigma\theta < 1+\sigma/R+\sigma\theta(R-1)/R$ for all R. Therefore the fraction $(1+\sigma\theta)/(1+\sigma/R+\sigma\theta(R-1)/R) < 1$. Raising this fraction to the power t therefore means that $((1+\sigma\theta)/(1+\sigma/R+\sigma\theta(R-1)/R))^t$ is decreasing in t. From 32 observe that this means U_{ps} is decreasing in t too. As t goes to infinity the fraction and therefore U_{ps} goes to zero. **QED**

Proposition 4 implies that the cost of deviating increases with time while the benefit remains the same. The intuition behind this result is the following: As time goes on the productivity gap between the good a region is specializing in and the good is not producing is increasing. This is because human capital in the former is accumulating faster. Reverting to autarky is therefore increasingly more costly with time.

Proposition 5: Equilibrium cooperative tariffs fall with time.

Proof: From proposition 4 the cost of deviating increases with time. From 32 V_{Dt}, or the benefit of deviating is independent of time. Therefore, more cooperation can be supported or in other words τ_c will decrease to equate the two sides of 32. **QED**

The implication of this is that more cooperation can be supported with time, which implies that equilibrium cooperative tariffs fall with time. Depending on the parameters, free trade will eventually be achieved. To derive the conditions for this case let T be the first period that free trade is achieved. From T on all tariffs will be zero and therefore the gross tariffs $\tau_{ct}=1$ for t=T.....∞. 32 for time T then becomes

$$\frac{\tau_{Dt}R}{2(1+\tau_{Dt})+(R-1)(1+\tau_{Dt})^2}-\frac{1}{4}<$$

$$\frac{\delta}{4}\frac{1}{1-\delta(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})^2}-\frac{1}{4}\frac{\beta h_{b0}}{\alpha h_{a0}}(\frac{(1+\sigma\theta)}{(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})})^T\frac{\delta(1+\frac{\sigma}{R}+\sigma\theta\frac{R-1}{R})(1+\sigma\theta)}{1-\delta(1+\frac{\sigma}{2R}+\sigma\theta\frac{2R-1}{2R})^2} \quad (33)$$

The lowest integer T that satisfies 33 will be the first period that free trade is achieved.

Proposition 6: For some parameters values free trade is never achievable.

Proof: 1) Let δ=0. Observe that the right-hand side of 33 is zero in this case.

1) The left-hand side is never negative. To show this, assume that it is possible for it to be negative. Then each region can unilaterally choose $\tau_{Dt} = \tau_{ct}$. In that case, the left-hand side of 33 becomes zero since the deviating tariff and the cooperative tariff are equal. Since this is an improvement over the previous τ_{Dt} that τ_{Dt} was not a best response.

2) Since the left-hand side is positive and the right hand side is zero no positive value of T can satisfy 33. **QED**

In this case, cooperative tariffs will still be decreasing with time (proposition 5) but they will converge to a positive tariff as t goes to infinity.

The key result of this section is that the model exhibits a trade liberalization process that looks a lot like the WTO process. In other words, self-enforcing agreements lead to decreasing tariffs with time. Figure 2 illustrates the result. As time goes on productivity in each of the two sectors increases. However, because each region is specializing in their comparative advantage good, productivity in that sector increases faster. This of course is a direct consequence of the fact that internal spillovers are more efficient than external ones ($\theta<1$). This reinforces each region's comparative advantage. Also, note that this period's tariffs do not affect next period's growth as long as regions keep specializing and trading. So as long as tariffs are non-prohibitive and regions specialize the productivity gap between the two sectors increases over time.

This increases the cost of reverting back to autarky because the region will have to produce the low productivity good as well. This means that as time goes on punishments become more and more severe. As punishments become more severe higher levels of cooperation can be supported, leading to decreasing cooperative tariffs with time.

5: Common Market formation

The previous sections generalized the results of the Devereux paper to a model with more than two countries. We now have a non-stationary dynamic trade

liberalization model in the context of which we can study the formation of Common Markets. Common Market formation will be represented in the model by a fall in the number of regions from R_0 to R_1. To keep the model symmetric at all times, I will assume that R is the same for foreign and home regions before and after the formation of Common Markets. Common Markets between regions of opposite types will not be considered. This assumption allows me to isolate the impact of the market power effect.

Other papers use similar methods of modeling preferential trade agreements. Bagwell and Staiger used a very similar method to model the formation of Customs Unions in their 1997 paper. In their other 1997 paper dealing with Free Trade Areas they use agreements with non-modeled countries and do not allow free trade areas between their two modeled countries. To investigate trade liberalization after the formation of regional trade pacts we need to make sure that some regions that trade remain. One of the simplest ways of doing that is to assume only two traded goods and two types of countries that can not enter into regional pacts with countries of the opposite type. This also seems to correspond broadly to the pattern of regionalism observed in the real World. With the notable exception of NAFTA we usually observe regional pacts between similar countries.

In general, Common Markets can affect trade liberalization in a number of ways. They are usually thought of as having a trade creation, a trade diversion and a market power effect. This market power effect is what makes regional trade pacts better deviators and better enforcers. In this model, the market power effect is derived from the impact of Common Markets on the rate of human capital accumulation. Rivera-Batiz and

Romer investigate the links between regionalism and growth. I will investigate the impact of these links on the market power effect.

In the context of this model Common Markets have two effects. The first effect is a once off level effect. This arises from the fact that bigger regions have more workers and therefore produce and consume more of the good. Due to the structure of the utility function this will lead to a once off increase in income per capita[3]. However this effect will have no impact on trade liberalization because it will affect V_{Dt} and V_c (equation 32) proportionately.

The second effect is an increase in the rate of growth of human capital. Larger regions now produce more domestically, which increases the rate of growth of productivity. Again this is a product of the fact that flow of technical knowledge is more efficient internally than externally. This will affect different parts of 32 differently and will therefore impact the trade liberalization process. It is precisely this effect that I will investigate.

Before proceeding in examining that issue it is important to address the reasons why Common Markets exhibit this growth effect. After all, what is it that makes the spillover of technical knowledge faster after the creation of a Common Market? Once again a formal explanation can be found in Rivera-Batiz and Romer. They consider trade in ideas, as well as trade in goods. Governments restrict trade in ideas for the same reasons they restrict trade in goods, to give domestic producers an advantage over foreign producers. In the presence of Common Markets such restrictions are lifted and ideas are

[3] The utility function exhibits increasing returns to scale. I will completely ignore this effect since it has no impact on cooperative tariffs.

traded freely. This leads to an increase in the production of ideas and therefore an increase in human capital accumulation.

A number of informal explanations can also be used to explain this. For example, firms now have an additional tool in finding out how goods are produced. This tool is reverse engineering. Before the formation of the Common Market there is no trade between regions of the same type because they are identical. However their markets are integrated after the Common Market so they can now buy and reverse engineer goods. In addition to that, capital and labor can now move freely between the two regions. Hiring labor from the other region will increase knowledge spillovers. Also, with the free movement of capital we might now have mergers between firms from different regions. Both of these effects seem to exist in different degrees in the European Union, the only Common Market in existence. Labor and capital movements however, will not be modeled here. Finally, one can also argue that there is a closer relationship between firms within a Common Market. For example, firms will probably belong to the same organizations and will also take part in more of the same trade shows.

Since the purpose of the paper is to examine the impact of Common Markets on trade liberalization I will concentrate on their growth effect from now on, ignoring the level effect. The timing and the decision to join a Common Market will be exogenous to the model. I will assume that external political factors determine the decision of if and when to join a Common Market. A lot of analysts argue that this assumption is not that far from the truth. They argue that political reasons as opposed to economic ones play a big role in the timing of Common Markets. The initial stages of what is now the European Union is the example most often sited. Most analysts agree that the main

motivation behind the establishment of the European Union was to avoid another devastating war between Germany and France. Nevertheless, endogeneizing this decision will be an interesting extension to this paper.

I will consider two distinct Common Market formation processes. In the first case, all players are surprised by the formation of the Common Markets. This is not a very realistic assumption but it is relatively easy to evaluate. In the second and more realistic case, at some point regions become aware that some Common Markets are politically feasible. For every period after that there is a constant probability λ that the Common Market will happen next period. That probability does not vary with time and Common Markets can only happen once.

In both cases I will divide the impact of Common Markets into two parts. The first will be the immediate one-time change in tariffs and the second will be the change in the rate of decline of cooperative tariffs or the change in the future path of cooperative tariffs.

I: Common Markets as a surprise

Assume that before the start of a given period t the number of regions goes down from $R_0=2$ to $R_1=1$[4]. Specifying the number of regions will make the impact of Common Markets easier to evaluate. All the results generalize to any change in the number of regions. I will first distinguish between the immediate one time shock due to Common Market formation and the change in the path of future tariffs.

[4] This will mean that according to 28 I am only going to consider cooperative tariffs less than 2.

a) The immediate impact of Common Market formation

To evaluate the immediate effect we need to look at the impact of Common Markets on each of the components of 32. Recall that the level effect of Common Markets will not affect the trade liberalization process. I will therefore concentrate on the growth effect.

From 29, lowering the number of regions will first of all increase the rate of human capital accumulation from $(1+\sigma/2+\sigma\theta/2)^2$ to $(1+\sigma)^2$ when regions are cooperating (U_{coop}). From 32, observe that the impact of this will be to increase the cost of deviating (V_c) making cooperation more likely.

In addition, it will increase the rate of human capital accumulation in the punishment phase from $(1+\sigma/4+3\sigma\theta/4)^2$ to $(1+\sigma/2+\sigma\theta/2)^2$. This increase in human capital accumulation in the punishment phase will increase the welfare from autarky (U_p). From 32, observe that this will reduce the cost of deviating making cooperation less likely.

Proposition 7: Reducing R will increase the immediate cost of deviating V_c.

Proof: 1) Show that $U_{coop} \geq U_p$. Assume $U_{coop}<U_p$. Then in equilibrium every region can do better by reverting to autarky. This means that cooperation is not a subgame perfect equilibrium. That is a contradiction.

2) The increase in the growth rate is higher in U_{coop} than U_p.

$(1+\sigma)^2-(1+\sigma/2+\sigma\theta/2)^2>(1+\sigma/2+\sigma\theta/2)^2-(1+\sigma/4+3\sigma\theta/4)^2$

3) Reducing R therefore increases the U_{coop} more than U_p (they increase the high number by more than the low number). **QED**

Proposition 7 shows that Common Markets increase the cost of deviating just as the market power effect suggests.

The next step is to examine what happens to the benefit of deviating. The cooperating welfare for the same period will remain unchanged, U_{ct}, because labor decisions and human capital are already fixed for that period. However, this is not the case with the period welfare from deviating, U_{Dt}.

Proposition 8: A reduction in R will increase V_{Dt}. ($\partial V_{Dt} / \partial R < 0$ for $R \geq 1$)

Proof: Substitute 26 into V_{Dt} (defined in 32) and differentiate with respect to R. **QED**

Proposition 8 again shows the market power effect of Common Markets. In other words, Common Markets make for better deviators. The intuition behind Proposition 8 is fairly simple. As regions become larger they have more to gain by deviating because that deviation now affects a bigger market. Common markets, therefore, lead to an increase in the deviating tariff, τ_{Dt}, which in turn leads to an increase in the benefit from deviating.

As the market power effect suggests Common Markets increase both the benefit and the cost of deviating. If the increase in cost dominates then cooperative tariffs will decrease. Otherwise it will increase. This will depend on the parameter values and especially on the discount factor δ.

Proposition 9: The higher the value of δ the more likely it is that Common Markets will lower immediate tariffs.

Proof: 1) First from 32 observe that V_{Dt} is independent of δ. This implies that $\partial V_{Dt} / \partial R$ is also independent of δ.

2) Show that $\partial V_c / \partial R$ is increasing in δ. From Proposition 7 $\partial U_{coop} / \partial R > \partial U_p / \partial R$. From the second part of the proof of proposition 7 the term multiplied by δ in $\partial U_{coop} / \partial R$ is bigger than that in $\partial U_p / \partial R$ (from 31). This implies that $\partial V_c / \partial R$ is increasing in δ.

3) Therefore the cost of deviating increases by more as δ increases while the benefit remains constant. This implies that more cooperation can be supported. **QED**

The intuition behind this result is relatively straightforward. Common Markets increase the benefit and the cost of deviating. The benefit of deviating is realized right away while the cost is incurred in the future. A high discount factor implies that the future is more important to the regions, therefore, the increase in cost dominates. This leads to more cooperation.

Proposition 9 also establishes a second result. Common Markets could lead to an immediate increase or decrease in tariffs depending on the values of the parameters. For example, if $\delta(1+\sigma)=1$, $\partial V_c / \partial R$ will be infinite while $\partial V_{Dt} / \partial R$ will be finite. No matter what the other parameters are, Common Markets will lead to free trade in all possible situations. Similarly if $\delta(1+\sigma)=0$, $\partial V_c / \partial R = 0$ while $\partial V_{Dt} / \partial R$ will be positive (proposition 8). Therefore, in some cases all Common Markets lead to an immediate drop in tariffs ($\delta(1+\sigma)$ is high) while in others all Common Markets lead to an immediate increase ($\delta(1+\sigma)$ is low).

Equation 32 with $R=R_0$ gives the trade liberalization path before the Common Market formation and 32 with $R=R_1$ gives the path after Common Market formation. The impact of Common Markets on immediate tariffs at any time t is given by

$$\frac{1}{(1+\tau_{ct})^2} = \delta\sum_{i=0}^{\infty}(\delta(1+\sigma)^2)^i \frac{\tau_{ct+1+i}}{(1+\tau_{ct+1+i})^2} - \frac{1}{4}\frac{\beta h_{b0}}{\alpha h_{a0}}\left(\frac{(1+\sigma\theta)}{(1+\frac{\sigma}{2}+\frac{\sigma\theta}{2})}\right)^t \frac{\delta(1+\sigma\theta)^2}{1-\delta(1+\frac{\sigma}{2}+\frac{\sigma\theta}{2})^2} \tag{34}$$

Note that 34 is the same as 32 with R=1 except for the fact that the productivity gap b_t/a_t only grows at the slower rate corresponding to R=2. That is because for the previous t periods without Common Markets it was growing at that rate. Let V_{cIt} be the right-hand side of 34.

To compare the trade liberalization paths under the two regimes I will assume that

$$\Delta V_{ct}(R_1) \geq \Delta V_{ct}(R_0)$$
$$\Delta V_{cIt} \geq \Delta V_{ct}(R_0) \tag{35}$$

The first condition ensures that the two trade liberalization paths only cross once. The second ensures that the immediate impact curve and the trade liberalization path before Common Markets only cross once. Both conditions are technical and they are sufficient but not necessary for single crossing.

Proposition 10: The trade liberalization path after Common Markets, $\tau_{ct}(R_1)$, is steeper than $\tau_{ct}(R_0)$, the trade liberalization path before Common Markets. Also, the immediate impact curve τ_{cIt} is steeper than $\tau_{ct}(R_0)$.

Proof: Note that the right hand side of 34 and that of 32 with $R=R_1$ are the same. Also note that $\partial V_{Dt}(R_1)/\partial\tau_{ct} < \partial V_{Dt}(R_0)/\partial\tau_{ct}$. This means that for both $\tau_{ct}(R_1)$ and τ_{cIt} it takes a

larger decrease in tariffs to reduce the left-hand side of the relevant incentive by the same amount as that in $\tau_{ct}(R_0)$. From 35 notice that in both cases the change in the right-hand side is bigger. Therefore, both paths are steeper than $\tau_{ct}(R_0)$. **QED**

The intuition behind proposition 10 is the following. Recall that the productivity gap is increasing faster after Common Markets. This means that at anytime t the increase in the benefit of cooperation is higher after Common Markets. Also, after Common Markets the benefit of deviating becomes less sensitive to tariff changes. This suggests that it takes a larger change in tariffs after Common Markets to increase the benefit of deviating by the same amount. These two effects combined suggest that the trade liberalization path after Common Markets is steeper. In other words the benefit of cooperation increases more after Common Markets and at the same time it takes a larger decrease in tariffs to adjust for even the same change in the benefit of cooperation.

Now compare the immediate impact curve with the trade liberalization path before Common Markets. The change in the productivity gap is the same. This is because before Common Markets are formed the productivity gap grows at the slower rate. It is only after regionalism that the higher growth is achieved. However, as soon as Common Markets are formed the benefit of deviating becomes less sensitive to changes in tariffs.. Recall that for the same change in the benefit of cooperation it takes a larger change in tariffs to adjust. Therefore, the immediate impact curve is steeper than the trade liberalization path before regionalism but flatter than that after regionalism. Another property of the immediate impact curve is that if Common Markets happen at time zero then the tariff at zero would be the same as that implied by the trade

liberalization path after regionalism. This is because at that time the productivity gap is the same for all three cases.

Proposition 11: The later a Common Market is established the more likely it is that it is going to lead to a drop in immediate tariffs.

Proof: From proposition 10 the immediate impact curve is steeper than the trade liberalization path before Common Markets. Then there are three possibilities.

1) The immediate impact curve starts above the trade liberalization curve but it is not steep enough to intersect it before they both converge to their limits. However since the immediate impact curve is steeper the difference between the two gets smaller with time. This means that the later Common Markets are formed the smaller the immediate increase in the tariffs would be.

2) The immediate impact curve starts below the trade liberalization curve. As time goes on the immediate impact curve gets further away from the trade liberalization curve because it is steeper. Therefore, the later the Common Markets are formed the higher the immediate decrease in the tariffs would be.

3) The immediate impact curve starts higher than the trade liberalization curve but it is steep enough to intersect it. Initially, the immediate impact curve is above the trade liberalization curve but because it is steeper it gets closer and closer until eventually it crosses and starts getting further away. So the later Common Markets happen the more likely it is that they are going to lead to a decrease in immediate tariffs. **QED**

Figure 3 illustrates these results. The dotted line in all three panels represents the immediate impact curve. It is not the path that cooperative tariffs will follow after

jumping to that level. That is yet to be determined. Panel A shows the case where all Common Markets no matter when they take place lead to an increase in tariffs (low δ). Panel B shows the case where no matter when Common Markets happen they lead to a decrease in tariffs (high δ). Note that in this case the immediate impact curve and the trade liberalization path before liberalization can never cross. This is because the immediate impact curve is steeper and it starts below the trade liberalization curve. The most interesting case is Panel C which presents the intermediate case. The early Common Markets increase immediate tariffs while the late ones decrease tariffs.

The intuition behind proposition 11 is the following. Common Markets increase the cost of deviating. They also increase the benefit of deviating. The former does not vary with time but the latter does. The reason is pretty simple. In periods of deviation or cooperation regions are still specializing. The only thing that changes with time is the productivity gap which is only relevant in the punishment periods when regions have to produce both goods.

Therefore, the key effect here will be the one on autarky welfare. As time goes on the productivity gap increases, which reduces this welfare. The impact of Common Markets on this welfare is proportional to this productivity gap. Therefore this impact increases with the value of the productivity gap. As the productivity gap gets wider Common Markets reduce this welfare more, which in turn means they increase the benefit of cooperation more. This means that more cooperation can be supported through time. In other words, cooperative tariffs are more likely to decrease with time as Common Markets are formed. It is precisely dynamic results like Proposition 11 that can only be achieved with the use of non-stationary dynamic trade liberalization models.

Point A[5] in Panel C of Figure 3 is the point where the immediate impact is zero. Common Markets before this point lead to an immediate increase in tariffs while those after this point lead to an immediate fall. In this way the point A summarizes all the relevant information on the immediate impact of Common Markets for this case. It is therefore worthwhile to perform comparative statics on A and investigate its properties.

Proposition 12: A exists and is unique for the case in Panel C Figure 3.

Proof: From proposition 10 the immediate impact curve implied by 34 is steeper than the trade liberalization path implied by 32 for $R=R_0$. Also note that both curves are monotonic, downward sloping and continuous. By assumption, in Panel C the limit of the immediate impact curve is at least as low as that of the trade liberalization curve before Common Markets. Therefore, by continuity, monotonicity and the fact that the immediate impact curve is steeper, A exists and is unique. **QED**

Proposition 13: For the case in Panel C Figure 3:

1) An increase in δ will shift A to the left.
2) An increase in σ will shift A to the left.
3) An increase in θ will shift A to the right.
4) An increase in $\beta h_{b0}/\alpha h_{a0}$ will shift A to the right.

Proof: 1) From 34 an increase in δ will increase the right hand side (by argument 2 in the proof for Proposition 9). That will lower the cooperative tariffs. Therefore at the

[5] Point A should not be thought of as the optimal time to have Common Market formation. That is because there is a trade off between lower tariffs right now and how early we reach free trade. It might be that free

previous point A the immediate impact is to lower tariffs. This and Proposition 12 imply that the new point A will be to the left of the old point A.

2) From the right hand side of 34 an increase in σ will increase U_{coop} more than U_p therefore increasing the cost of deviating supporting more cooperation at the old point A. This and proposition 12 imply that the new point A will be to the left of the old point A.

3) From 34 notice that an increase in θ increases U_p leaving everything else unchanged. That decreases the cost of deviating leading to less cooperation at the old point A. This and proposition 12 imply that the new point A will be to the right of the old point A.

4) From 34 an increase in $\beta h_{b0}/\alpha h_{a0}$ will increase U_p leaving everything else unchanged. This decreases the cost of deviating leading to less cooperation at the old point A. This and proposition 12 imply that the new point A is to the right of the old point A. **QED**

The intuition behind the first statement of proposition 13 is that increasing the discount factor increases the impact of Common Markets on the cost of deviating. This is because the cost of deviating is incurred in the future while the benefit is incurred right away. A higher discount factor makes the future more important.

An increase in σ will increase the rate of growth of human capital accumulation. This will increase the value of future cooperation (U_{coop}) and the value of autarky (U_p). It will however increase the former more than the latter because in cooperation regions specialize and more of the production is done internally, absorbing the full impact of the increase in σ. That is not true in autarky because in that case more of the production is done externally and the impact of σ is neutralized by θ.

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trade is achieved by having Common Markets as soon as possible since the rate of decline of tariffs is faster

In addition an increase in θ will diminish the difference between internal and external knowledge. The productivity gap will not be growing as fast which in turn means that the impact of Common Markets on the welfare from autarky will not be diminishing as fast. The punishment phase will no longer be as severe. In that case the increase in the cost of deviating because of the market power effect will be lower.

Finally, a decrease in the initial productivity gap (represented by an increase in $\beta h_{b0}/\alpha h_{a0}$) will mean that at any future time the productivity gap is smaller. A smaller productivity gap will mean that the increase in the welfare from autarky because of Common Markets will be bigger. This is because punishments will not be as severe. Devoting resources to the low productivity sector will not be as bad because of this smaller productivity gap. This means that the increase in the cost of deviating because of the market power effect is now lower leading to less cooperation.

b) The change in the path of cooperative tariffs due to Common Market formation

Common Markets will also change the path of tariffs after this initial one time shock. From that point on cooperative tariffs will be determined by 31 with $R=R_1$. It is exactly like starting the trade liberalization again with fewer regions and new initial conditions $b_{t'}/a_{t'}$ with t' being the time the Common Markets where formed. In other words the cooperative tariff path for any time $t > t'$ will be determined by

$$\frac{1}{(1+\tau_{ct})^2} = \delta \sum_{i=0}^{\infty} (\delta(1+\sigma+)^2)^i \frac{\tau_{ct+1+i}}{(1+\tau_{ct+1+i})^2} - \frac{1}{4}\frac{b_{t'}}{a_{t'}} \left(\frac{(1+\sigma\theta)}{(1+\sigma)}\right)^{t-t'} \frac{\delta(1+\sigma)(1+\sigma\theta)}{1-\delta(1+\frac{\sigma}{2}+\frac{\sigma\theta}{2})^2} \tag{36}$$

with bigger regions.

From proposition 10 the trade liberalization path is steeper for $R=R_1$ than $R=R_0$. This identifies the last part of the puzzle. After the initial immediate shock tariffs will start falling faster according to 36. The intuition behind this is that the productivity gap grows faster after Common Markets are formed. This is because fewer regions means that a larger proportion of World production is produced internally, leading to faster growth in the comparative advantage sector. That increases the productivity gap faster and makes punishments more severe faster. Therefore cooperative tariffs start falling faster.

Figure 4 illustrates the situation for the intermediate case shown in Figure 3 (Panel C). The dotted line as in Figure 3 represents the immediate impact. A couple of examples of the path of cooperative tariffs for different cases ($t'=t_1$ and $t'=t_2$) are shown. It is important to note that these paths are steeper than the previous path. Recall that these represent the trade liberalization process described in section 4 with $R=R_1$ and different initial conditions $b_{t'}/a_{t'}$.

All the panels in Figure 3 illustrate another interesting point. The immediate impact of the Common Market formation will lead to tariffs higher than those that would be observed if the process was started with $R=R_1$ from time zero[6]. The reason for this is that if Common Markets happen in period t, b_t/a_t will be more than if we had t periods with $R=R_0$. Therefore, starting with R_0 regions for t periods will lead to a lower productivity gap which would lead to a lower cost of deviating thus leading to less cooperation.

II: Common Markets as a three-stage process

[6] Except the case where Common Markets are formed at time zero.

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

This new game can now be divided into 3 stages. In stage 1 regions are unaware of the possibility of Common Market formation. There are R_0 of each type of regions and these regions play the dynamic tariff game described in the previous section. In the second stage there are still R_0 regions of each type but regions now anticipate the possibility of future Common Market formation. In stage 3 Common Markets happen and there are now only R_1 regions of each type. Regions now play the infinitely repeated game described in the previous section but with a fewer number of regions. Again, I will distinguish between the one-time immediate impact of Common Market formation from the change in the future path of cooperative tariffs.

a) The immediate impact of Common Market formation

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 32 with $R=R_1$. For stage 1 it will be given by 32 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 proposition 5. In other words, these two sequences are both decreasing with time.

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

$$\frac{\tau_{Dt^*}R_0}{(1+\tau_{Dt^*})(1+\tau_{ct^*})+(R_0-1)(1+\tau_{Dt^*})^2}-\frac{\tau_{ct^*}}{(1+\tau_{ct^*})^2}=$$

$$Z_{t^*}-\frac{1}{4}\frac{\beta h_{b0}}{\alpha h_{a0}}\left(\frac{(1+\sigma\theta)}{(1+\frac{\sigma}{R_0}+\sigma\theta\frac{R_0-1}{R_0})}\right)^{t^*}\frac{\delta(1+\frac{\sigma}{R_0}+\sigma\theta\frac{R_0-1}{R_0})(1+\sigma\theta)}{1-\delta(1+\frac{\sigma}{2R_0}+\sigma\theta\frac{2R_0-1}{2R_0})^2} \qquad (37)$$

Notice that this is the same as the relevant equation in stage 1 except from Z_{t^*}. Equation 37 gives the immediate impact of Common Market formation if $t^*=t$. To characterize the sequence of tariffs in this stage $\{\tau_{ct}^2\}$ we need to consider two separate cases with the latter being steeper than the former.

Case 1

In the first case assume that at the time we switch from stage 1 to stage 2 the cooperative tariffs with R_1 regions are less than those with R_0 regions.

Proposition 14: In case 1, there will be a fall in immediate tariffs as we move from stage 1 to stage 2.

Proof: 1) Show that Z_t is higher than U_{coop} with $R=R_0$.

In stage 2, governments know that eventually stage 3 will happen. In stage 3, cooperative welfare is U_{coop} with $R=R_1$. By assumption this is higher than U_{coop} with $R=R_0$. This

higher welfare will be receiving a positive weight in Z_t. Z_t will therefore be a weighted average of the two U_{coop} and therefore bigger than the smaller of the two.

2) Since the only difference between 32 and 37 is replacing U_{coop} with Z_t and Z_t is higher apply the argument in proposition 5 (i.e. cost of deviation increases more than benefit). Cooperative tariffs are therefore lower. **QED**

Proposition 14 suggests that there will be an immediate fall in tariffs when we shift from stage 1 to stage 2.

The next thing to consider is what happens as we move from stage 2 to stage 3. Unfortunately not a lot can be said about this case. To show that, observe that the only difference between 34 and the equation for stage 3 is Z_{t^*}. By assumption we know that 32 with $R=R_0$ (stage 1) gives higher cooperative tariffs than 32 with $R=R_1$ (stage 3). Now compare Z_{t^*} with the cooperative welfare in stage 3. Proposition 14 shows that Z_{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. Therefore the increase in the benefit of deviating from stage 2 to stage 3 is the same but the increase in the cost is lower. Since we don't know the relative values of these we can only conclude that tariffs could go either up or down as we move from stage 2 to stage 3.

Figure 5 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[7].

Case 2

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 proposition 11 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 Z_{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 6.

Proposition 15: The later the start of stage 2 happens the more likely it is that case 1 is true.

Proof: This is a corollary of proposition 11. What distinguishes case 1 from case 2 is the fact that $\tau_{ct}(R=R_1) < \tau_{ct}(R=R_0)$. Proposition 11 shows that this is more likely to happen late in the trade liberalization process (which corresponds exactly to stage 1). **QED**

[7] The same argument as that in proposition 5 can be made. The independence of the probability of moving

Proposition 15 generalizes proposition 11 for the more complicated Common Market formation process. In other words the later Common Markets become feasible the more likely it is that they will lead to an immediate fall in tariffs.

Figure 7 illustrates the results. The dotted line represents the immediate impact of Common Markets becoming feasible (i.e. going from stage 1 to stage 2). Figure 7 corresponds to Figure 3 Panel C. As in that case we can define point A as the point where moving from stage 1 to stage 2 leaves tariffs unchanged.

Proposition 16: Point A exists and is unique.

Proof: Note that the immediate impact curve implied by 36 and the trade liberalization path implied by 32 with $R=R_0$ are both decreasing, continuous and monotonic. From proposition 15 note that for early t the immediate impact curve is above the trade liberalization curve and for late t it is below. By continuity and monotonicity point A exists and is unique. **QED**

Proposition 16 generalizes the results of proposition 12 to this more complicated Common Market formation process.

Proposition 17: For the two-stage Common Market formation process:

1) An increase in δ will shift A to the left.

2) An increase in σ will shift A to the left.

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from stage 2 to stage 3 means that Z_{t^*} does not change with time. The only thing that changes with time is of course the effect on autarky welfare.

3) An increase in θ will shift A to the right.

4) An increase in $\beta h_{b0}/\alpha h_{a0}$ will shift A to the right.

Proof: 1) From 37 an increase in δ will increase the right hand side. An increase in δ will increase both Z_t and U_p. It will however increase Z_t more since the growth rates it multiplies in Z_t are higher. That will lower the cooperative tariffs at the old point A. Therefore at the previous point A the immediate impact is to lower tariffs. This and Proposition 16 imply that the new point A will be to the left of the old point A.

2) From the right-hand side of 37 an increase in σ will increase U_{coop} more than U_p therefore increasing the cost of deviating supporting more cooperation at the old point A. This and proposition 16 imply that the new point A will be to the left of the old point A.

5) From 37 notice that an increase in θ increases U_p leaving everything else unchanged. That decreases the cost of deviating leading to less cooperation at the old point A. This and proposition 16 imply that the new point A will be to the right of the old point A.

6) From 37 an increase in $\beta h_{b0}/\alpha h_{a0}$ will increase U_p leaving everything else unchanged. This decreases the cost of deviating leading to less cooperation at the old point A. This and proposition 16 imply that the new point A is to the right of the old point A. **QED**

Proposition 17 generalizes the results of proposition 13 for the more complicated three-stage Common Market formation process.

<u>b) The change in the path of cooperative tariffs due to Common Market formation</u>

In this three-stage Common Market formation process we need to characterize the path for the tariffs in stage 2 and stage 3. Note that the path for stage 3 will be the same as that followed by tariffs in the simpler Common Market formation process of the previous section. All the results there in that section generalize. Specifically tariffs fall faster in stage 3 than stage 1 (Proposition 10).

To complete the picture we need to characterize the path for stage 2. The rate of decrease of cooperative tariffs depends on the rate of decrease in U_p. From 37 notice that U_p is the same for stages 1 and 2 and therefore its rate of decline is the same. All else being equal the rate of decline in stage 2 will be the same as in stage 1.

Figure 8 summarizes these results. The dotted line is again the immediate impact in moving from stage 1 to stage 2. The paths are shown for two possible time periods for the start of stage 2, t_1 and t_2. In conclusion, all the results obtained from the simple Common Market formation process generalize to this more complicated and more realistic process.

6: Results and intuition

The last section has established the following results:

1) Common Markets will lead to a one-time shock in tariffs and will also change the trade liberalization path after their formation.

2) Common Markets can lead to an increase or decrease in the immediate tariffs depending on the parameters. (Proposition 9).

3) Common Markets are more likely to lead to a fall in immediate tariffs if they happen later rather than earlier in the trade liberalization process (Propositions 11 & 15).

4) Comparative statics:

(a) The higher the discount factor the earlier Common Markets lead to a decrease in immediate tariffs

(b) The higher the rate of technology transfer σ the earlier Common Markets lead to a decrease in immediate tariffs.

(c) The bigger the difference between the efficiency of internal and external technology transfer (the lower the value of θ) the earlier Common Markets will lead to a decrease in immediate tariffs.

(d) The bigger the initial productivity gap (the higher the value of $\beta hb0/\alpha ha0$) the earlier Common Markets will lead to a decrease in immediate tariffs. (Propositions 13 & 17).

5) The rate of decline of tariffs increases after Common Market formation (Proposition 10).

These results prove that if regionalism is viewed in its proper context, that of a non-stationary dynamic trade liberalization model, its impact will differ through time. In other words, not all Common Markets are created equal.

The most important result about the one-time immediate effect of Common Markets is that later Common Markets are more likely to lead to a decrease in tariffs than earlier ones. This is an important result and is a major contribution to the literature, since it illustrates the dynamic implications of Common Markets. In other words, the impact of

Common Markets varies with time[8]. This is precisely the reason why we need to look into this issue in the context of a non-stationary context.

The intuition behind this result is the following. Common Markets affect the model by increasing the rate of human capital accumulation. That of course increases both the cost and the benefit of deviating as the market power effect suggests. the impact on the benefit of deviating does not vary with time. This is because in periods when we have either cooperation or deviation, regions are still specializing. The only variable that changes with time is the productivity gap between the two sectors which only affects autarky welfare since that is the only case when both goods are produced by both regions.

Over time, the impact on autarky welfare diminishes. Since the effect of this impact is to reduce the increase in the cost of deviating, over time this decrease is lower and the impact on the cost of deviating increases. This of course tips the balance in favor of cooperation making Common Markets more likely to decrease immediate tariffs.

But why is the impact of Common Markets on the punishment welfare diminishing through time? By making the regions bigger Common Markets increase the rate of human capital accumulation in all cases even in the autarky case. This welfare diminishes with time[9] because the productivity gap between the two sectors widens. Recall that autarky requires switching some production to the non-comparative advantage good. As this welfare diminishes with time the impact of Customs Unions is also going to diminish with time proportionately. For example, if Common Markets increase this welfare by 10%, 10% of a high welfare will be more than 10% of a low welfare. Therefore, the impact of Common Markets on autarky welfare diminishes with time.

[8] Time is not a state variable however. The impact of Common Markets depends on the state variable, which is the state of human capital, which in turn changes with time.

Another way of thinking about this result is the following. The rate of growth of human capital accumulation is higher the bigger the regions are. Therefore for a given increase in the productivity gap, tariffs will fall more under a regime with big regions (result 5). As time goes on with the smaller regions the productivity gap increases and some slack is created in the incentive constraint for the same gap with bigger regions. The later the switch from smaller regions to bigger regions takes place (the formation of Common Markets), the bigger the change in the productivity gap will be and the bigger the accumulated slack will be. This will lead to a bigger one-time shock in the form of lower tariffs. Since the cooperative tariffs for bigger regions start out higher (Figure 3 Panel C) this fall in tariffs might not be enough to drop tariffs below those in the small region regime.

Results 1 and 4 are interrelated. 1 suggests that is entirely possible that Common Markets could increase or decrease immediate tariffs depending on the parameters. 4 shows how those parameters affect the impact of Common Markets on immediate tariffs. An increase in the discount factor makes the time needed to get a decrease in tariffs shorter. Recall that the impact of Common Markets on the cost of deviating is in the future while the impact on the benefit is realized immediately. The trade off between those two will depend on the discount factor. A low discount factor will favor the impact on the benefit therefore making cooperation less likely. The reverse is true if the discount factor is high.

The same is true of an increase in the rate of technology transfer. Increasing this increases the value of specialization since specialization now leads to even higher growth. This will make the punishment phase more severe. The impact of Common

[9] The normalized version of this welfare is what's actually decreasing with time.

Markets on the cost of deviating will increase since it impacts a much higher number making cooperation more likely. The reverse is true of an increase in θ. This will reduce the benefits of specialization because the difference between internal and external technology transfers is smaller. This will make punishments less severe and the impact of Common Markets on the cost of deviating smaller leading to less cooperation.

Finally, the bigger the initial productivity gap the earlier Common Markets will lead to a decrease in immediate tariffs. The larger the initial productivity gap is the larger the productivity gap will be at any time. This means that reverting to autarky is much more severe. Therefore, the impact of Common Markets on autarky is diminished leading to a bigger overall impact on the cost of deviating. This tips the balance in favor of more cooperation. Recall that Common Market formation is like starting a trade liberalization process with $R=R_1$ with different initial conditions.

On top of this effect on immediate tariffs, Common Markets increase the rate of decline of tariffs after their formation. The intuition behind this is that with bigger regions the productivity gap grows faster. This is because regions now produce a larger share of the good at home so specialization is more valuable and leads to a higher growth rate in human capital accumulation. Since the productivity gap determines the rate of change of tariffs by making reversion to autarky increasingly more severe, Common Markets lead to a steeper decline in tariffs.

7: Conclusion

The paper examines the impact of Common Market formation in the context of a non-stationary dynamic model of trade liberalization and compares the results to the

existing literature. The main contribution is to examine how the impact of Common Markets varies through time. The key results of the model are that the later Common Markets happen the more likely it is that they will lead to a drop in immediate tariffs and that the rate of decline of tariffs increases after their formation. The first result is in complete agreement with previous work by the author based on a completely different trade liberalization model. Also, the result that a higher discount factor makes it more likely that Common Markets are going to lower immediate tariffs, a result first reported by Bagwell and Staiger and later by the author, was confirmed.

The results support the view that it is essential to study the impact of regionalism on trade liberalization using non-stationary dynamic trade liberalization models. Only then can one investigate the full impact of regionalism. It should not be a surprise that these effects are dynamic, or in other words change depending on when regionalism happens.

The scope of this paper was pretty limited to addressing the impact of Common Markets on trade liberalization. To keep things simple the formation of Common Markets was exogenous to the model. A natural extension will be to relax that assumption and make the decision to join a Common Market endogenous. Another possible extension would be to investigate what happens if Common Markets between regions of different types are allowed. Finally, one can relax the assumption that there are only two traded goods and allow each region to have a comparative advantage in a good and have monopolistic competition with other regions.

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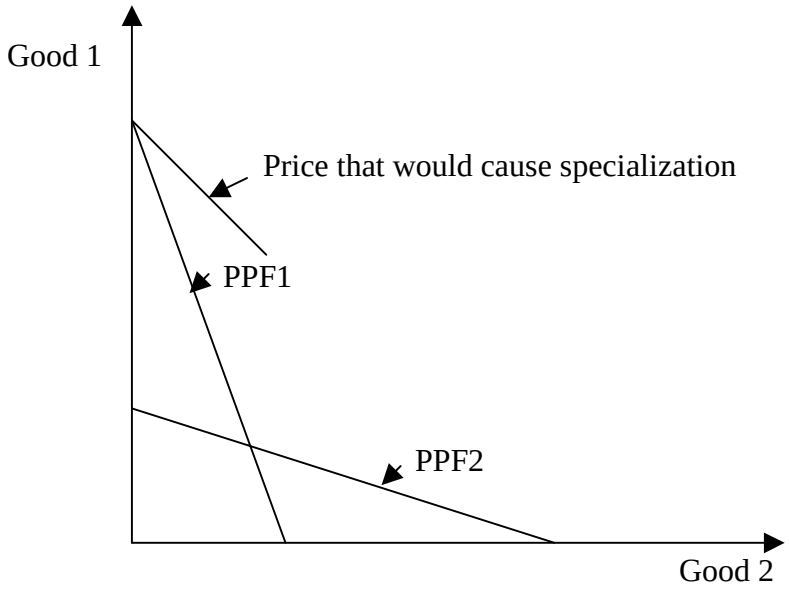
Figure 1



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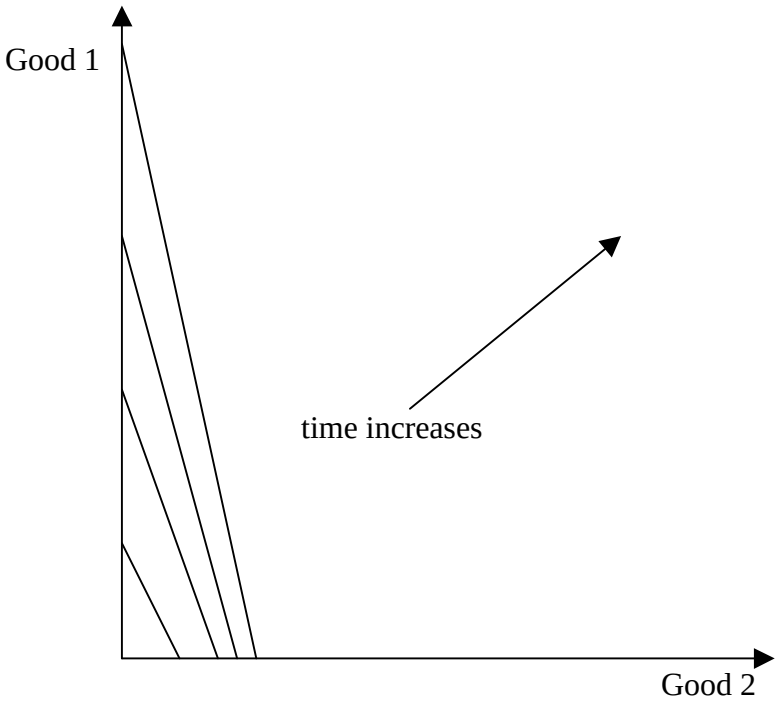

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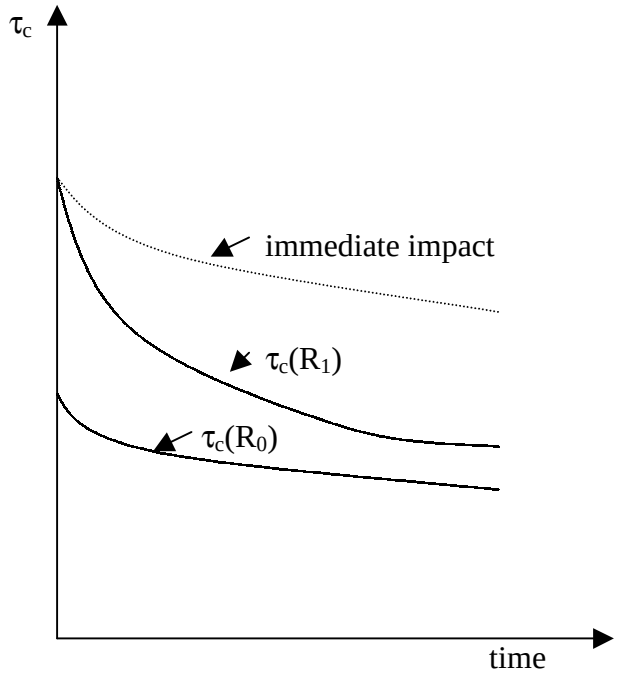
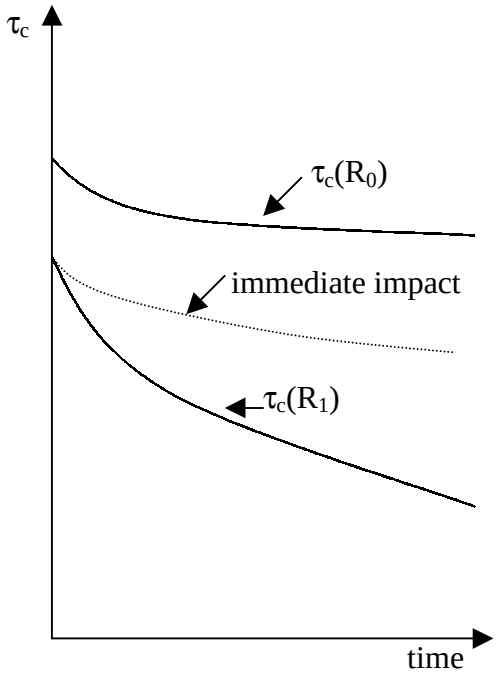


PANEL A



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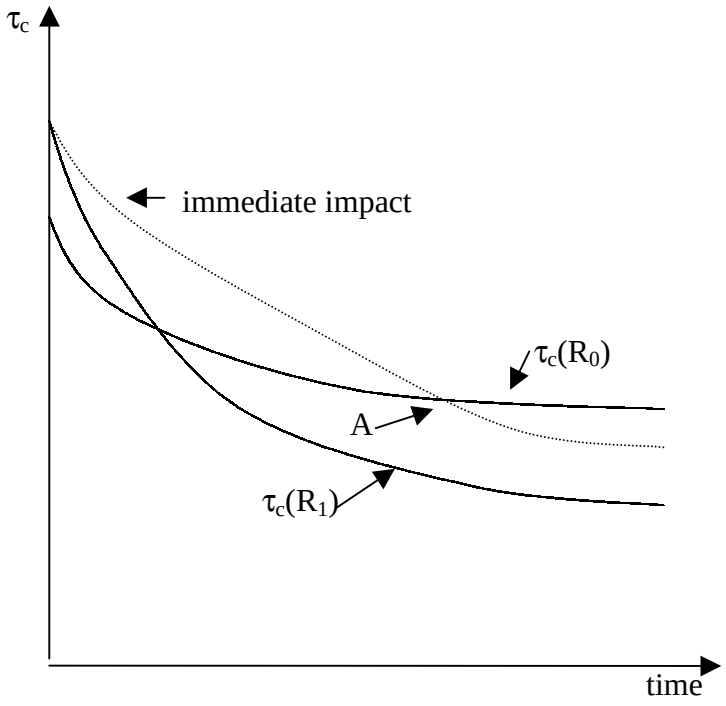


PANEL C

Figure 4

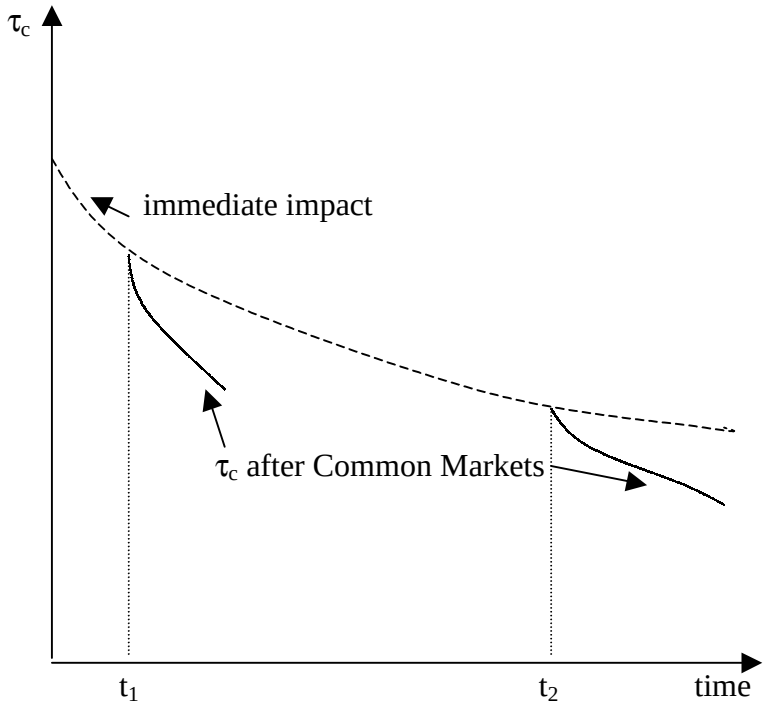


Figure 5

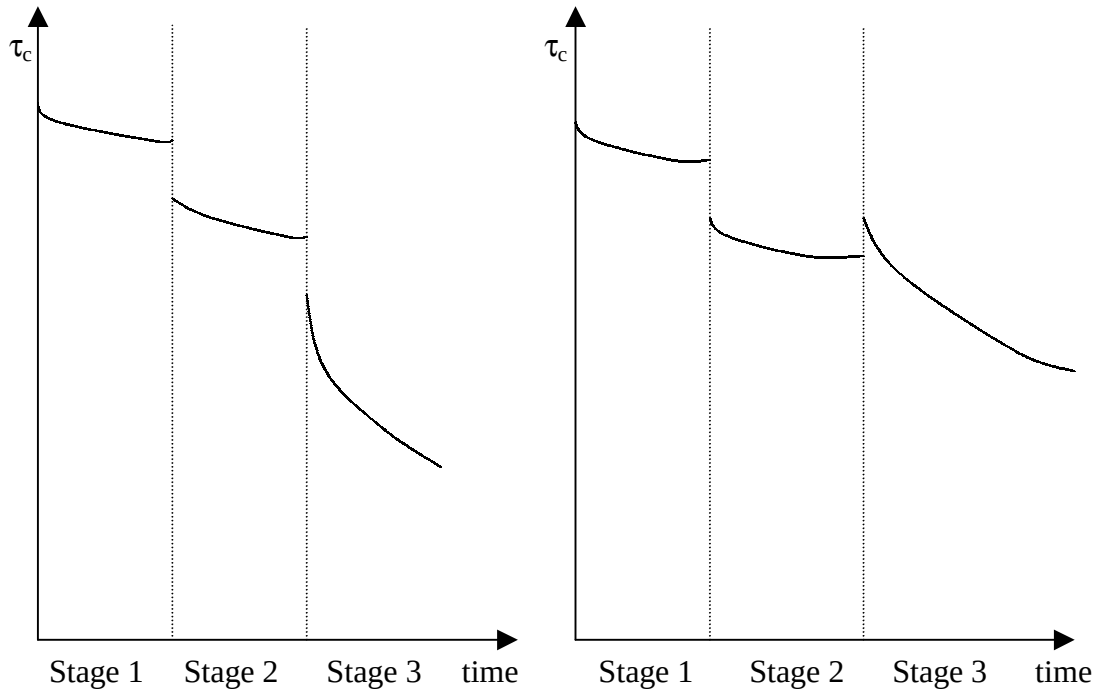


Figure 6

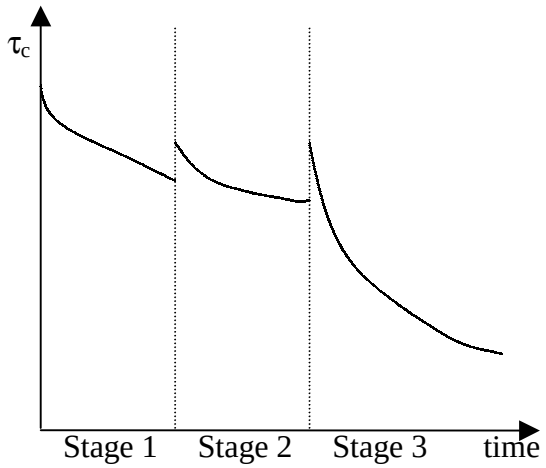


Figure 7

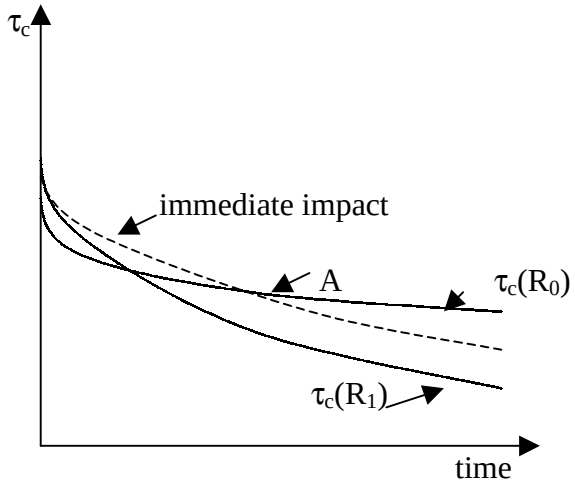
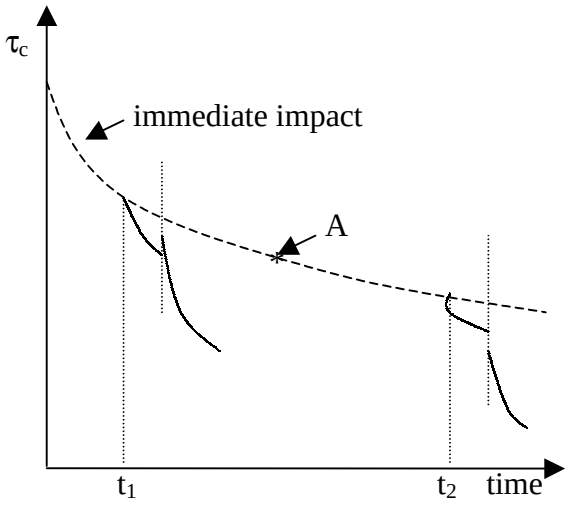


Figure 8



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