

UNEMPLOYMENT AND THE DECLINE OF
TRADE BETWEEN EASTERN EUROPEAN
COUNTRIES : A STRATEGIC ANALYSIS

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SUMMARY
UNEMPLOYMENT AND THE DECLINE OF TRADE BETWEEN
EASTERN EUROPEAN COUNTRIES : A STRATEGIC ANALYSIS

In a model of two Eastern European countries trading with each other and with the West, the paper studies the effect of liberalization of imports from the West. It is shown that, during the adjustment period when labor cannot move freely between sectors, and under the assumption of relative real wage rigidity, such an import liberalization implies too much unemployment and a too large decline of trade between Eastern European countries.

Policymakers of these countries can take policy measures in order to reduce or eliminate the inefficiencies implied by unnecessary unemployment. They can subsidize production or, alternatively, exports or imports of goods exchanged between them. However, the lack of cooperation between these countries may prevent such policies to be beneficial and may even make them worsen the situation.

The present analysis calls for a system of cooperative subsidies to trade between Eastern European countries during the period of adjustment. Otherwise, liberalization of imports from the West should be progressive, although, here also, the lack of cooperation between countries may involve too much liberalization.

RESUME
CHOMAGE ET DECLIN DU COMMERCE ENTRE PAYS DE
L'EUROPE DE L'EST : UNE ANALYSE STRATEGIQUE

Dans un modèle de deux pays de l'Europe de l'Est qui commercent entre eux et avec l'Ouest, on étudie l'effet de la libéralisation des importations en provenance de l'Ouest. On montre que, pendant la période d'ajustement où la main d'oeuvre ne peut pas se déplacer librement d'un secteur à un autre, et sous l'hypothèse de rigidité des salaires réels relatifs, une telle libéralisation des importations a pour conséquence un excès de chômage et un déclin trop important du commerce entre pays de l'Europe de l'Est.

Les décideurs politiques de ces pays peuvent prendre des mesures qui tentent de réduire ou d'éliminer les inefficiences liées au chômage excédentaire. Ils peuvent subventionner la production ou, alternativement, les exportations ou importations des biens qu'ils s'échangent entre eux. Cependant, l'absence de coopération entre ces pays peut empêcher de telles politiques d'être bénéfiques et peuvent même faire qu'elles détériorent la situation.

L'analyse présente supporte la mise en place, pendant la période d'ajustement, d'un système coopératif de subventions au commerce entre pays de l'Europe de l'Est. Dans le cas contraire, la libéralisation des importations en provenance de l'Ouest ne devrait être que progressive. Toutefois, en l'absence de coopération entre pays, la libéralisation tend à être trop importante.

Mots clefs : Pays de l'Europe de l'Est-Commerce international
-Coopération internationale-Tarifs et subventions -Libéralisation
des échanges.

Key words : Eastern European Countries-International Trade-International
Cooperation-Tariffs and Subsidies-Trade Liberalization.

J.E.L : F13, F15

1. INTRODUCTION

One of the main features of the transition to market economies of previously centrally planned economies in Eastern Europe has been the very large decline of trade between Eastern European countries, following the dismantlement of the CMEA. Indeed, under central planning, as these countries belonged to the same economic and political system, there was some important bias against trade with the West and consequently toward trade between themselves. It would therefore seem natural to observe the reversal of such a process when, as it is the case now, these countries liberalize their trade with the West.

However, this decline has also caused concern. First, there has been a rise in unemployment which is associated with the decrease of output in the sector producing the goods which were previously exported to Eastern Markets. Even if there is some counterbalancing increase of trade with the West, existing empirical evidence suggests that this increase has not been the result of reorientation of sales from Eastern markets to Western markets. Most of the goods which were produced in order to be exported to other Eastern European Countries were highly specific, and therefore quite unmarketable to the West. Second, the decline of Eastern trade has been so large that the fall of its share in total trade now seems to overshoot its long-run value¹.

This concern with the almost collapse of trade between Eastern European Countries, has led to proposals for payments systems along the line of the European Payments System which was put in place in Europe after World War II². However, one could argue that after the establishment of currency convertibility and payments in hard currencies for trade between these countries, one of the main advantages of such a system, the substitution of a multilateral clearing mechanism to bilateralism, disappears³ (although its role of facilitating temporary balance of payments disequilibria may remain). Nonetheless, various partial agreements between countries of Eastern Europe, sometimes involving barter, are still being made and seem to indicate the need for some wider cooperative agreement⁴.

In this paper we will show that, under currency convertibility, non-cooperative behavior of countries of Eastern Europe actually inefficiently reduces the production of goods traded between them and creates unnecessary unemployment during the transition period. As a consequence, there is too much overshooting in the decline of trade between these countries. Therefore, even under currency convertibility, there is a need for some cooperative agreement to increase trade between Eastern European countries during the transition period. Our argument is not related to the issue of financing temporary balance of payments disequilibria, which has been underlined in the literature (and which, as indicated above, could still may call for some payments system).

The model will incorporate several important features which we just mentioned as relevant for the issue at hand. First, the elimination of barriers that Eastern European countries put on their trade with the West should lead to a decline of the amount of trade they had between themselves, because this trade was artificially boosted by these barriers under central planning. Second, goods produced for exports in the Eastern market are not the same as those produced for the Western market and cannot be exported to the West. Third, in the short-run, there are some adjustment costs which prevent factors of production to be shifted from the sector producing goods for Eastern trade to the sector producing goods being exported to the West. Fourth, unemployment is likely to be the short-run outcome of a decline of the demand for goods previously traded between Eastern European countries.

We consider a model of two countries, the Eastern European countries, trading both with each other and with the West. We study the effects of the elimination of trade restrictions on imports from the West and show that this would involve an inefficiently too high level of unemployment and a too large decline of trade between Eastern European countries. This leads us to examine the possible policy responses to this problem. We show that the absence of cooperation between these countries may prevent such policies to be beneficial. This stresses the importance for Eastern European countries to cooperate with each other. On that point, our analysis more particularly underlines the usefulness

for these countries to cooperatively subsidize their mutual trade during the adjustment period.

Section 2 presents the model. Section 3 studies the effects of liberalization of imports from the West. Section 4 considers the first best solution and shows that such policies may not be adequate in the absence of cooperation between countries. Sections 5 to 7 examine other policy responses, both in a cooperative and in a non-cooperative setting. Section 8 summarizes the results and concludes.

2. THE MODEL

2.1. The framework

We consider a model of two Eastern European countries, country 1 and country 2, which trade with each other and with the West. There are four goods and one factor of production, labor. There are two kinds of goods. Some can be internationally traded (good 1 and good 2) and some can only be traded between the two Eastern European countries and, therefore, are not tradable with the West (good 3 and good 4). These will be called "Eastern goods". As indicated in the Introduction we make this distinction in order to take into account an important feature of trade between Eastern European countries : the sale of the goods produced for these markets cannot be reoriented toward the Western markets. Our assumption that these goods are not tradable with the West tries to pick up this aspect.

We assume constant returns to scale in the production of goods. Thus, we have a Ricardian type of model of trade where goods are produced according to comparative advantage. We will make the simplifying assumption that the model is symmetric relatively to the two Eastern European countries. These two countries are assumed to have the same cost functions for the two internationally traded goods. The West is considered as large with respect to the two Eastern European countries, so that the terms of trade with the West are given. The terms of trade and comparative advantage of Eastern countries are such that each Eastern country only produces one of the two internationally traded

goods. Because of our symmetry assumption, they produce the same good, which we will take as being good 1. Therefore, they export good 1 to the West and import good 2 from the West.

The two Eastern European countries have different comparative advantages in the production of Eastern goods, which creates an incentive to trade between them. Each country only produces one of these goods : country 1 produces good 3, and country 2 produces good 4. Finally note that, as there will be no incentive for these two countries to trade internationally traded goods between themselves, these goods are only traded with the West, and can also be called "Western goods".

To summarize, each Eastern European country produces two kinds of goods, one internationally traded good exported to the West, and one Eastern good exported to the other country. It also imports two other goods, one from the West, and one from the other Eastern European country. Thus, country 1 produces good 1 and good 3, and imports good 2 from the West and good 4 from country 2 ; while country 2 produces good 1 and good 4, and imports good 2 from the West and good 3 from country 1.

In each Eastern European country there is a representative consumer who can consume the four goods. Let $u(c_1, c_2, c_3, c_4)$ and $u^*(c_1^*, c_2^*, c_3^*, c_4^*)$ be the utility functions of the representative consumers of country 1 and country 2 respectively, the c_i (or c_i^*) being the consumption of good i (a star is added to variables of country 2).

2.2. The long-run equilibrium

The equilibrium condition under free trade and in the absence of any taxes or subsidies, when labor is completely mobile between sectors in each country (which will be our "long-run" equilibrium), can be written

$$(1) \quad p_i = p_i^* = 1 \quad i = 1, 2, 3, 4$$

$$(2a) \quad e(p, u) = q_1 + q_3$$

$$(2b) \quad e^*(p^*, u^*) = q_1^* + q_4^*$$

$$(3a) \quad e_3(p, u) + e_3^*(p^*, u^*) = q_3$$

$$(3b) \quad e_4(p, u) + e_4^*(p^*, u^*) = q_4^*$$

$$(4a) \quad q_1 + q_3 = \bar{L}$$

$$(4b) \quad q_1^* + q_3^* = \bar{L}$$

where $e(p, u)$ is the expenditure function, giving the minimum amount of income required to reach the utility level u when the price vector is $p = (p_1, p_2, p_3, p_4)$. Our simplifying assumption that the model is symmetric with respect to the two countries implies the following restriction on the expenditure functions e and e^* :

$$(5) \quad e^*(p_1, p_2, p_3, p_4, u) \equiv e(p_1, p_2, p_4, p_3, u)$$

q_1 is the output of good 1 in country 1 and q_1^* the output of good 1 in country 2. $\bar{L}$ is the exogenously given supply of labor, which, in accordance with our symmetry assumption, is assumed to be the same in countries 1 and 2.

Equations (1) indicate, first, that relative prices are equal in the two countries, which is simply the consequence of free trade, and the absence of any taxes or subsidies, and, second, that relative prices are constant (with an appropriate normalization and the choice of a common numeraire, say good 1, this can be written as (1)). To understand why relative prices are constant, note first that our assumption that the terms of trade with the West are given implies that the relative prices of good 1 and good 2 are given in each country. Then, note further that our assumption of constant returns to scale with one factor of production implies that, when this factor is perfectly mobile within each country, the relative price of goods 1 and 3 is constant in country 1, and that the relative price of goods 1 and 4 is constant in country 2. As a consequence, all relative prices are constant.

Equations (2) indicate that expenditures are equal to income in each country where we have implicitly used (1) in these equations. For, as explained below, we exclude any international borrowing. Equations

(3) express equilibrium conditions in the markets for Eastern goods, where e_i is defined as $e_i(p,u) \equiv \frac{\partial e(p,u)}{\partial p_i}$ (we know that this is equal to the compensated Hicksian demand for good i , so that e_i is equal to c_i , the consumption of good i). Equations (4) give (with an appropriate normalization) the equilibrium condition in the labor market in each country. Given (1), the system of 6 equations (2)-(4) allows to determine the 6 unknowns $(q_1, q_3, q_1^*, q_4^*, u, u^*)$.

2.3. The transition period

These equations describe the equilibrium when there is perfect mobility of labor between sectors in each country, which correspond to the long-run. However, in the adjustment period toward this long-run equilibrium, labor cannot immediately move from the sector producing the Eastern good (the "Eastern sector") to the one producing the Western good, i.e. good 1, (the "Western sector"). There are some transaction costs, training costs, and also some costs linked to the migration from one geographical area of the country to another (which may be especially relevant when the housing market has not yet been made fully competitive).

Therefore, we have to take into account these barriers to labor mobility when we consider the adjustment period from the initial situation, which is a legacy of the centrally planned economy (which we will describe below) to the "long-run" equilibrium which is obtained when labor has fully adjusted. There is obviously a large degree of arbitrariness in giving a formal content to these impediments to labor mobility. Here, we will try to handle them in a rather simple way. Let divide time into periods. Assume that it requires one period of unemployment for a worker to move from the Eastern sector to the Western sector, and that, in a given period, the Western sector can increase its employment at most by N units of labor.

More formally, consider for example country 1. The initial employment (or output according to our normalization) in the Western sector is denoted by $\bar{q}_1^0$ and the initial employment (or output) in the

Eastern sector is denoted by $\bar{q}_3^0$, where we have $\bar{q}_1^0 + \bar{q}_3^0 = \bar{L}$ (initially we have full employment because the centrally planned economy is assumed to be so). Now let q_1^L and q_3^L be the long-run equilibrium values of q_1 and q_3 which are given by the previous equilibrium conditions (1)-(4), where we also have $q_1^L + q_3^L = \bar{L}$. Let us for the moment assume that we have $q_1^L > \bar{q}_1^0$ (this issue is discussed in more details in Section 3 below), so that a total amount of labor $M = q_1^L - \bar{q}_1^0 = \bar{q}_3^0 - q_3^L$ has to be transferred from the Eastern sector to the Western sector. If we want to make this transfer as quickly as possible, we will have unemployment at least equal to N each period until period t^L where the long-run equilibrium is reached (we have $N(t^L-1) < M \leq Nt^L$). We assume $M > N$, which means that the adjustment will necessarily take more than one period. If, however, unemployment is less than N in any period, a lower amount of labor is transferred and the adjustment will take more time.

Let $(\bar{q}_1^t, \bar{q}_3^t)$ and $(\bar{q}_1^{*t}, \bar{q}_4^{*t})$ be the sequence of the capacity outputs during this adjustment process. We have $\bar{q}_1^{t+1} - \bar{q}_1^t$ and $\bar{q}_3^t - \bar{q}_3^{t+1}$ at most equal to N . Taking a typical period of adjustment, and dropping the index t for notational convenience, we have

$$(6) \quad \bar{q}_1 + \bar{q}_3 = \bar{L}, \quad \bar{q}_1^* + \bar{q}_4^* = \bar{L}$$

$$(7) \quad \bar{q}_1 < q_1^L, \quad \bar{q}_1^* < q_1^{*L}$$

$$(8) \quad \bar{q}_3 > q_3^L, \quad \bar{q}_4^* > q_4^{*L}$$

Now consider the equilibrium values of outputs during such a period. In the Western sector, the output can be exported to the West without any restriction at the given international prices. Therefore, output is always equal to capacity, and therefore we can write (again, dropping the index t from actual output (q_1^t, q_3^t) or (q_1^{*t}, q_4^{*t})).

$$(9) \quad q_1 = \bar{q}_1, \quad q_1^* = \bar{q}_1^*$$

In the Eastern sector some unemployment is created because it is assumed that there is some rigidity of prices or wages during the adjustment process. We will make the simplifying extreme assumption that

relative real wages between sectors are completely rigid. In that case, wages are still equalized between sectors, as in the case where labor is fully mobile, and consequently equations (1) still hold (in the absence of any taxes or subsidies). The equilibrium outputs of the Eastern sector satisfy the capacity constraints :

$$(10) \ q_3 \leq \bar{q}_3 ; \ q_4 \leq \bar{q}_4^*$$

We will assume that Eastern European countries cannot borrow in the international capital market. This means that they cannot smooth their consumption path, consuming more than their incomes during the adjustment period when their incomes are lower while reimbursing later on . They always consume the income of the period.

As a consequence of this assumption we simply have two kinds of static analysis. One concerns the long-run equilibrium, and the other a typical period during the adjustment process, which we will also call the "short-run" equilibrium. Under free trade and no taxes or subsidies, the first equilibrium is described by equations (1)-(3), and the second equilibrium by equations {(1)-(4), (9), (10)}, where the $(\bar{q}_1, \bar{q}_3)$, $(\bar{q}_1^*, \bar{q}_4^*)$ satisfy equations (6)-(8). Note that the symmetry of the model implies $\bar{q}_1 = \bar{q}_1^*$, $\bar{q}_3 = \bar{q}_4^*$, $q_1^L = q_1^{*L}$ and $q_3^L = q_4^{*L}$.

2.4. Additional assumptions

Furthermore, when we examine the policy responses to the effects of liberalization of imports from the West (Sections 4 to 7 below) we will make a simplifying additional assumption. We will assume that the optimal transfer of labor from the Eastern sector to the Western sector is actually equal to the maximum value N which is technically feasible (except maybe for the last period of the adjustment process). This implicitly assumes that N and the discount rate are low enough to make it non-optimal to slow down the adjustment process. As a consequence, the optimizing problem of policymakers will consist in maximizing the utility of the representative individual of the current period under the constraint that unemployment is at least equal to this technically feasible value, which can be written (except for the last period)⁵

$$(11a) \ q_3 \leq \bar{q}_3 - N$$

$$(11b) \ q_4^* \leq \bar{q}_4^* - N$$

During the transition period, The maximizing problem of policymakers is thus reduced to such a static problem, where unemployment $(\bar{q}_3 - q_3)$ has to be higher or equal to some given minimal value N .

Finally, we have to make some more specific assumptions on the utility functions. Beside some regularity assumption like being twice differentiable, we will make two kinds of additional assumptions. The first one rules out too pathological cases by assuming that all goods are normal (i.e. are not inferior), which can be written

$$(12) \ e_{iu} > 0$$

where we define $e_{iu} \equiv \frac{\partial e}{\partial p_i \partial u}$

Second, we will assume some degree of substitution between Western goods and Eastern goods. A minimal assumption would be that they are net (Hicksian) substitutes, which can be written

$$(13) \ e_{13} > 0, \ e_{14} > 0, \ e_{23} > 0, \ e_{24} > 0$$

where we define $e_{ij} \equiv \frac{\partial e}{\partial p_i \partial p_j}$

However such an assumption may too weak. For example, it may be compatible with gross (Marshallian) complementarity if income effects dominate. Although we will not have to assume that goods are gross substitutes, we may nonetheless need some additional assumptions concerning the substitution of goods, and the issue will be further discussed in Section 3.

3. EFFECTS OF LIBERALIZATION OF IMPORTS FROM THE WEST

We will consider that, under central planning, the Eastern European countries restricted imports from the West through either explicit tariffs or implicit tariffs implied by the absence of currency convertibility⁶. Such an import tax may be rationalized if we consider that for political or military reasons, the authorities put a ceiling on imports from the West⁷. The central planning bureau is supposed to have set quantities produced and traded according to the equilibrium associated with these tariffs. Therefore, the initial conditions of the model, which yields initial outputs $(\bar{q}_1^0, \bar{q}_3^0)$ and $(\bar{q}_1^{*0}, \bar{q}_4^{*0})$, can be considered as the solutions of the long-run model of Section 2 which has been modified to take into account such tariffs. In that case, equations (1) and (2) have to be replaced respectively by

$$(14) \quad p_2 = 1 + t_2, \quad p_2^* = 1 + t_2^*, \quad p_1 = p_1^* = 1 \text{ for } i=1,3,4$$

$$(15a) \quad e(p,u) = q_1 + q_3 + t_2 e_2(p,u)$$

$$(15b) \quad e^*(p^*,u^*) = q_1^* + q_4^* + t_2^* e_2^*(p^*,u^*)$$

where t_2 and t_2^* are the tariff rates on imports from the West (good 2) put by country 1 and 2 respectively. Our symmetry assumption implies that we have $\bar{t}_2^0 = \bar{t}_2^{*0}$ where $\bar{t}_2^0$ and $\bar{t}_2^{*0}$ are the initial tariff rates (under central planning). Therefore we also have $\bar{q}_1^0 = \bar{q}_1^{*0}$ and $\bar{q}_3^0 = \bar{q}_4^{*0}$.

The change which will be analyzed in this paper is that of liberalization of imports from the West. We will consider that the tariff rates on imports are being put equal to zero. (In Section 7 below we will also consider the possibility for these tariff rates to be endogenously determined by policymakers). In this section we will analyze the effects of such a change in tariff rates (from $t_2 = \bar{t}_2^0 = \bar{t}_2^{*0} > 0$ to $t_2 = t_2^* = 0$). In later sections, we will examine the issue of the possible policy responses to these effects.

We therefore take the model with a tariff rate (t_2, t_2^*) , just described in (14) and (15), and analyze the effects of a change in the

tariff rates (t_2, t_2^*) , in the case where $t_2 = t_2^*$. First consider the effect on the output of the Eastern sector. As explained in Section 2, the fall of this output in the long-run is at the basis of the analysis of the present paper. On that point, we will simply remark that, in order to obtain such an effect, we have to assume more substitution between Eastern goods and imports from the West than is contained in the assumption of these goods being net (Hicksian) substitutes made at the end of Section 2. To see that, we can write

$$\begin{aligned} dq_3 &= de_3 + de_3^* \\ &= e_{32} dt_2 + e_{32}^* dt_2^* + e_{3u} du + e_{3u}^* du^* \end{aligned}$$

When we have $t_2 = t_2^*$ and $dt_2 = dt_2^*$, this implies (using the symmetry assumption (5)).

$$(16) \quad dq_3 = (e_{32} + e_{42}) dt_2 + (e_{3u} + e_{4u}) du$$

The first term (the coefficient of dt_2), which is the substitution term, implies that trade liberalization has a negative effect on the output of the Eastern sector. Individuals substitute imports from the West (good 2) to Eastern goods (goods 3 and 4), which decreases the demand for these goods. There is however a second effect going through the change in the utility levels of the representative consumers. In the long-run this effect goes into the opposite direction. For, as it is well known, trade liberalization increases welfare by reducing price distortions. Formally, we obtain (for $t_2 = t_2^*$ and $dt_2 = dt_2^*$)⁸.

$$(17) \quad \frac{du}{dt_2} = \frac{t_2 e_{22}}{e_{1u} + e_{2u} + e_{3u} + e_{4u}}, \text{ which is negative when we have } t_2 > 0.$$

The condition $dq_3/dt_2 > 0$ consequently becomes

$$(18) \quad e_{32} + e_{42} + \frac{e_{3u} + e_{4u}}{e_{1u} + e_{2u} + e_{3u} + e_{4u}} t_2 e_{22} > 0$$

Therefore, we see that the fact that imports from the West are net (Hicksian) substitutes of Eastern goods may not be enough in order for trade liberalization with the West to decrease outputs of Eastern goods in the long-run. We have to make a stronger assumption. We could assume that Eastern goods are gross ("Marshallian") substitutes for Western imports⁹. However such an assumption is not necessary. For example, we also obtain a fall in the demand for Eastern goods with any CES utility function, even when the elasticity of substitution is less than 1, in which case goods are net (Hicksian) substitutes but gross (Marshallian) complements¹⁰. To sum up, we will assume enough substitution between Eastern goods and imports from the West in order to obtain a fall in the output of the Eastern sector in the long-run. Inequality (18) is assumed to hold.

Now consider the effect on the demand for Eastern goods during the adjustment period. We can write

$$q_3^L = x_3(p^F, y^L) + x_3^*(p^{*F}, y^{*L})$$

$$q_3^S = x_3(p^F, y^S) + x_3^*(p^{*F}, y^{*S})$$

where $x_i(p, y)$ is the (Marshallian) demand for good i as a function of the price vector p and income y , where p^F and p^{*F} are the free trade price vectors, equal to $(1, 1, 1, 1)$, and where the indices L and S refer to the values of the corresponding variables in the long-run and in the adjustment period respectively (the "short-run"). Under free trade we have $y = q_1 + q_3$, which gives $y^S < y^L$, because of the existence of some unemployment in the short-run. As all goods are normal, this implies that output in the Eastern sector is smaller in the short-run than in the long-run, and therefore that the short-run decline overshoots its long-run decline. We therefore have

$$q_3^S < q_3^L$$

This inequality indicates that the amount of unemployment during a given period of the adjustment process is larger than the total amount

of labor that remain to be transferred until the long-run equilibrium is reached :

$$\bar{q}_3 - q_3^S > \bar{q}_3 - q_3^L > 0$$

Then, except for the last period of the adjustment process (see footnote 5), we can write

$$(19) \quad \bar{q}_3 - q_3^S > \bar{q}_3 - q_3^L > N > 0$$

where N is the maximum amount of labor that can be transferred in one period, as defined in Section 2 above.

As it is clear from (19), there is some excess in unemployment in the short-run which comes from two factors. First, unemployment reduces the demand for Eastern goods below its long-run level. Second, as the adjustment process takes more than one period, the total amount of labor which has to be transferred until the long-run is attained is larger than the necessary amount of unemployment.

Therefore, trade liberalization with the West involves some excess in unemployment during the adjustment process. This is a source of inefficiency which should lead policymakers to take some corrective policy measures, and we will study such policies in the rest of the paper.

The same kind of analysis can be developed for trade between Eastern European countries ("Eastern trade"). If we assume that the substitution between imports from the West and imports from the other Eastern countries is large enough, we have a decline of Eastern trade in the long-run. The condition can be written¹¹

$$(20) \quad e_{42} + \frac{e_{4u}}{e_{1u} + e_{2u} + e_{3u} + e_{4u}} t_2 e_{22} > 0$$

And we can also write

$$c_4^L = x_4(p^F, y^L)$$

$$c_4^S = x_4(p^F, y^S)$$

Therefore during the adjustment process, the decline of Eastern trade overshoots its long-run decline because of the reduced demand due to unemployment. Furthermore, the excess in unemployment that we have just emphasized makes the decline of Eastern trade too large in the short-run and consequently leads to too much overshooting.

4. SUBSIDIZING THE OUTPUT OF THE EASTERN SECTOR

As it is well known from the traditional theory of domestic distortions, the optimal policy should be directed toward the source of the distortion. Here it is the rigidity of relative real wages between sectors which creates the distortion during the period of adjustment. Therefore, the optimal policy should consist in subsidizing wages in the Eastern sector. Given the one factor constant returns to scale technology, this is actually equivalent to subsidizing the output of the Eastern sector¹². The optimal subsidies would actually mimic the equilibrium relative prices when the amount of unemployment is just equal to its minimal level N required for the intersectoral transfer of labor. This corresponds to the equilibrium prices in an exchange economy where country 1 would supply $\bar{q}_1$ of good 1 and $\bar{q}_3 - N$ of good 3, and country 2 $\bar{q}_1^*$ of good 1 and $\bar{q}_4^* - N$ of good 4. Then, no unnecessary unemployment would occur.

This is not however the end of the story because such a policy would be optimal only if it is set cooperatively by the two Eastern European countries. However this is not likely to be the case. Additional inefficiencies may therefore be created by the lack of cooperation between countries, and the resulting non-cooperative equilibrium may even be worse than the situation where, as in Section 3, there were no policy responses at all.

The reason lies in the externalities going primarily through the terms of trade. When a country subsidizes the output of its Eastern sector it worsens its terms of trade and improves that of the other country. In the absence of cooperation the favorable effect on the welfare of the other country of this change in the terms of trade is not taken into account. This tends to make policymakers subsidize less than it is optimal, as they try to prevent the terms of trade deterioration. This may even lead these policymakers to tax this output in order to improve the terms of trade. In that last case, the outcome would be worse than the no policy situation depicted in Section 3, and it would have been better to eliminate such a policy option.

In our formal model, equations (1) and (2) should be replaced by

$$(21) \quad p_i = p_i^*, \quad i=1,2 ; \quad p_3 = p_3^* = 1 + \eta_3 ; \quad p_4 = p_4^* = 1 + \eta_4^*$$

$$(22a) \quad e(p,u) = q_1 + (1+\eta_3)q_3$$

$$(22b) \quad e^*(p^*,u^*) = q_1^* + (1+\eta_4^*) q_4^*$$

where η_3 and η_4^* are the taxes on the output of the Eastern sector in country 1 and 2 respectively.

The analysis is developed in Appendix 1. As expected, we find that the cooperative policy consists in subsidies ($\eta_3=\eta_4^* < 0$) and leads to the minimum unemployment level. However we also find that the lack of cooperation between countries may give very different results. As an illustration, take the case of a CES utility function

$$(23) \quad u(c_1, c_2, c_3, c_4) = \left[\sum_{k=1}^n \lambda_k c_k^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 0, \quad \lambda_k > 0, \quad \sum_{k=1}^n \lambda_k = 1$$

and, to simplify the analysis, consider the case $\lambda_3=\lambda_4$. Then, it can be shown (see Appendix 1) that the result depends on the value of the elasticity of substitution σ . In the case $\sigma > 1/2$ we find that the non-cooperative equilibrium is the cooperative solution, and therefore no inefficiency arises. However, in the case $\sigma < 1/2$ we obtain $\partial u / \partial \eta_3 > 0$.

This means that it always pay for policymakers of a given country to increase taxes. The cooperative solution is not a non-cooperative equilibrium (as we have $\partial q_3 / \partial \eta_3 < 0$, the first order conditions are not satisfied). In fact there does not exist such an equilibrium. Instead, there is a tendency for policymakers to increase taxes toward infinity, which leads to the disappearance of the Eastern sectors, with its corresponding effect on unemployment in each country. Finally, in the case $\sigma=1/2$, we have $\partial u / \partial \eta_3 = 0$ for all values of η_3 , which leads to a continuum of non-cooperative equilibria, the cooperative solution being only one of them. These results highlight the possible large inefficiencies associated with non-cooperative behavior between countries.

The possible inefficiencies of the non-cooperative equilibrium which are linked to terms of trade effects are indeed well known in the trade literature. Here, we simply want to underline that, for the issue at hand, they may prevent the optimal policy response to be put into place. This leads us to the search for other policies.

5. SUBSIDIZING TRADE BETWEEN EASTERN EUROPEAN COUNTRIES

We have seen that the decline of Eastern trade is also too large, which leads to the idea that it could be subsidized¹³. In the context of our analysis, looking at policies of subsidizing Eastern trade may be of interest for two reasons. First, as in any second best situation, (which, as we have seen, may occur when we consider the non-cooperative equilibrium) it may be better to use taxes or subsidies on Eastern trade rather than on the output of the Eastern sector (even if the last policy instruments would be preferred if cooperative). Second, cooperation between countries may be easier when policies concerning their mutual trade are involved. As explained in the Introduction, there are some existing proposals or practices which go into that direction.

Trade may be subsidized through exports subsidies or import subsidies. Because of the symmetry of the model with respect to the two countries, the bilateral balance of trade between the two Eastern countries must be equal to zero in equilibrium and therefore the

cooperative solution does not depend on whether export or import subsidies are used. When countries do not cooperate, however, the result may be quite different.

5.1. Import subsidies

Consider first the case of import taxes or subsidies. Then equations (1) and (2) of the model should be replaced by

$$(24) \quad p_1 = p_1^* \quad i=1,2 ; \quad p_3 = p_4^* = 1 ; \quad p_4 = 1 + t_4, \quad p_3^* = 1 + t_3^*$$

$$(25a) \quad e(p,u) = q_1 + q_3 + t_4 e_4(p,u)$$

$$(25b) \quad e^*(p^*,u^*) = q_1^* + q_4^* + t_3^* e_3^*(p^*,u^*)$$

where t_4 (or t_3^*) is the tax rate that country 1 (or country 2) levies on imports of good 4 (or good 3). The formal analysis is developed in Appendix 2. Considering, first, the cooperative solution, we find (for $t_4 = t_3^*$)

$$(26) \quad \frac{\partial(u+u^*)}{\partial t_4} = - \frac{e_{41} + e_{42}}{e_{1u} + e_{2u}} < 0$$

Under our assumptions of normality of goods and of Western goods and Eastern goods being net (Hicksian) substitutes, we see that it is always beneficial to increase subsidies to Eastern trade. As a consequence, Eastern trade is subsidized until the minimum level of unemployment is reached¹⁴. This can be written

$$t_4^C = t_3^{*C} < 0$$

$$q_3^C = \bar{q}_3 - N \quad , \quad q_4^{*C} = \bar{q}_4^* - N$$

where the subscript "C" means "cooperative".

The reason of this result is that the additional welfare losses due to increased unemployment (which shows up as a decreased supply of Eastern goods produced) are always greater than the additional welfare gains due to reduced price distortions associated with lower subsidies. Note, however, that although the minimum (and also optimum from the first best point of view) unemployment is reached, the present cooperative solution is only a second best. For, as indicated in Section 3 above, the first best solution involves subsidies to production of the Eastern sectors. Thus, although the supplies of goods are the same in the two cases, the relative prices are different. These distortions in relative prices imply welfare losses.

The non-cooperative equilibrium may involve unnecessary unemployment with lower subsidies or even positive tariff rates. We have

$$\begin{aligned} t_4^{NC} &\geq t_4^C \\ q_3^{NC} &\leq q_3^C \end{aligned}$$

where the index "NC" means "non-cooperative".

The reason is that policymakers do not take into account the increase in the welfare of the other country that a lower tax rate (or an increased subsidy) would imply through lower unemployment (the demand for the Eastern good produced by the other country would be raised). Only the trade-off between lower domestic distortions and higher domestic unemployment is taken into account by policymakers in each country.

As a consequence, the lack of cooperation between countries would lead to a too large decline of their mutual trade. For, we can write

$$e_4^C - e_4^{NC} = \int_{t_4^{NC}}^{t_4^C} e_{44} dt_2 + \int_{u^{NC}}^{u^C} e_{4u} du \geq 0$$

where the inequality follows from the assumption of goods being normal, from $t_4^{NC} \geq t_4^C$ (and $e_{44} < 0$) and from $u^C \geq u^{NC}$ (by definition of the

cooperative solution). Both the substitution effect of a lower subsidy and the effect of the decline in the utility level due to higher unemployment, imply a decline in the demand for imports.

As an illustration, consider the case of the CES utility function (23). For simplicity we will restrict the analysis to the case $\sigma \leq 1$ ($\sigma = 1$ being the Cobb-Douglas case). Note that, as we have seen in Section 3, the first best solution may not be attained non-cooperatively in that case. As shown in Appendix 2 we find that, at the non-cooperative equilibrium, the tariff rate $t_4^{NC} (=t_3^{*NC})$ has the sign of $\lambda_3 - \lambda_4$. As an implication, if the utility functions are the same in the two countries, in which case we have¹⁵ $\lambda_3 = \lambda_4$, free trade is the non-cooperative equilibrium. The explanation of this peculiar result is the following. Starting from the free trade situation consider the effect of a small subsidy or tax. There are, as indicated above, two effects on welfare. The first concerns price distortions for consumers. As these are minimized at the free trade situation, the corresponding marginal effect is zero. Therefore in order for free trade to be optimal for the policymaker of a given country, it must be that the marginal effect on domestic unemployment of a marginal subsidy or tax is also equal to zero. This actually happens in the CES case with $\lambda_3 = \lambda_4$. The reduction in domestic demand for the domestically produced Eastern good caused by a marginal subsidy on imports is just offset by the increased foreign demand for that good, which is itself the result of the beneficial effect on foreign unemployment of the subsidy.

If we compare these results for the non-cooperative equilibrium to those of Section 3 where there is no policy response, we see that in the special case just mentioned ($\lambda_3 = \lambda_4$) we would have exactly the same values for all variables. But, now, the situation would be the consequence of non-cooperative behavior of countries. In the case $\lambda_3 \neq \lambda_4$, the non-cooperative equilibrium may be better or worse depending on whether we have $t_2^{NC} < 0$ (case $\lambda_3 < \lambda_4$) or $t_2^{NC} > 0$ (case $\lambda_3 > \lambda_4$), respectively. It is worthwhile to note that this would also correspond to whether trade shares (i.e. trade from the other Eastern country and trade from the West expressed as shares of total trade, which vary

positively and negatively respectively with the ratio e_4/e_2) overshoot their long-run values or not. Such an overshooting of trade shares would be associated with positive tariff rates and would imply a situation worse than free trade, involving higher unemployment¹⁶.

5.2. Export subsidies

Now consider export subsidies. Then, instead of (24) and (25) we have

$$(27) \quad p_i = p_i^*, \quad i = 1, 2 ; \quad p_3 = p_4^* = 1 ; \quad p_4 = 1 + \theta_4^* , \quad p_3 = 1 + \theta_3$$

$$(28a) \quad e(p, u) = q_1 + q_3 + \theta_3 e_3^*(p^*, u^*)$$

$$(28b) \quad e^*(p^*, u^*) = q_1^* + q_4^* + \theta_4^* e_4(p, u)$$

where θ_3 (or θ_4^*) represent the tax the country 1 (or country 2) sets on exports to the other Eastern European country.

The cooperative solution is exactly the same as in the case of import subsidies. The non-cooperative equilibrium is different. In the case of import taxes, the terms of trade did not play any role. For, the assumptions of our model imply that tariffs on imports cannot change the terms of trade between Eastern European countries. This is why in the discussion of the non-cooperative equilibrium such terms of trade effects were absent. On the contrary, the terms of trade effects play a dominant role when we consider export taxes subsidies¹⁷, in the same way as they did when we considered taxes or subsidies on the output of the Eastern sector. This role will even be exacerbated because there is now no need to take into account the domestic price effect that an output tax or subsidy had. When unemployment is higher than the necessary level, the country is in a situation similar to that of a monopoly with a zero marginal cost curve (it costs nothing to produce additional Eastern goods through reduced unemployment). Thus, as shown in Appendix 2, in the case of a CES utility function, when the elasticity of substitution is less than 1 (in which case the elasticity of demand is

also less than 1) it always pay to raise the export tax. This tends to make trade between the two countries disappear, which leads to additional unemployment. (In the case $\sigma = 1$, which is the Cobb Douglas case, we have a continuum of equilibria). Again, these results highlight the possible large inefficiencies that may arise if we try to use export taxes or subsidies as policy instruments in a non-cooperative setting. And, for the same reason as in the case of tariffs on imports, the lack of cooperation implies a too large decline of Eastern trade.

6. SUBSIDIZING CONSUMPTION OF EASTERN GOODS

There are two components to output subsidy. One is an export subsidy and the other a consumption subsidy of the same magnitude. We have just seen how the first component, the export subsidy, may give rise to large inefficiencies in the absence of cooperation between countries. But it is possible that the second component, the consumption subsidy on the Eastern good domestically produced, being more "domestic", produces less externalities between countries. Therefore it could be less important for countries to cooperate on such policies.

First, we will consider the case where consumption taxes or subsidies are the only policy instruments. Then equations (1) and (2) of the model should be replaced by

$$(29) \quad p_1 = p_1^* = 1, \quad i = 1, 2 ; \quad p_4 = p_3^* = 1 ; \quad p_3 = 1 + \gamma_3, \quad p_4^* = 1 + \gamma_4^*$$

$$(30a) \quad e(p, u) = q_1 + q_3 + \gamma_3 e_3(p, u)$$

$$(30b) \quad e^*(p, u) = q_1^* + q_4^* + \gamma_4^* e_4^*(p, u)$$

Where γ_3 and γ_4^* are the consumption taxes on the domestically produced Eastern good in countries 1 and 2, respectively.

The formal analysis is developed in Appendix 3. When countries cooperate, we find

$$(31) \quad \frac{\partial(u+u^*)}{\partial\gamma_3} = - \frac{e_{31} + e_{32}}{e_{1u} + e_{2u}} < 0$$

Therefore, as in the case of subsidies to trade or to production, it is always beneficial to increase subsidies until all unnecessary unemployment disappear¹⁸. The welfare losses due to higher price distortions are smaller than the welfare gains due to increased output resulting from lower unemployment.

When countries do not cooperate we find (see Appendix 3)

$$(32) \quad \frac{\partial u}{\partial\gamma_3} = \frac{(e_{1u}+e_{2u})(1+\gamma_3) e_{33} - e_{4u}(e_{31}+e_{32})}{(e_{1u}+e_{2u})(e_{1u}+e_{2u}+2e_{4u})} < 0$$

which is also negative.

Therefore, even in the absence of cooperation, it is still beneficial for any country to unilaterally increase its subsidy. This implies that the non-cooperative equilibrium is actually identical to the cooperative solution. In both cases subsidies are set at the level required to make unemployment take its minimum (and first best optimum) value¹⁹. This means that, when considering such subsidies, the external effects between countries are small enough to make cooperation unnecessary.

This result suggests that the first best solution, which is reached through cooperative subsidies to the production of Eastern goods can also be reached through subsidies to trade between Eastern European countries. For, trade subsidy is the only component of the production subsidy which give rises to externalities between countries which are large enough to require cooperation. In fact, we can show that such a results holds in our model. To be more precise, equations (29) and (30) are now replaced by

$$(33) \quad p_1 = p_1^* = 1, \quad i = 1, 2 ; \quad p_3 = 1 + \gamma_3 ; \quad p_4 = 1 + t_4,$$

$$p_3^* = 1 + t_3^*, \quad p_4^* = 1 + \gamma_4^*$$

$$(34a) \quad e(p, u) = q_1 + q_3 + \gamma_3 e_3(p, u) + t_4 e_4(p, u)$$

$$(34b) \quad e^*(p^*, u) = q_1^* + q_4^* + \gamma_4^* e_4^*(p^*, u^*) + t_3^* e_3^*(p^*, u^*)$$

where, as before, γ_3 and γ_4^* are consumption taxes on the Eastern goods domestically produced, while t_4 and t_3^* are import taxes.

We assume that the choice of (t_4, t_3^*) is cooperative but that the choice of γ_3 and γ_4^* is non-cooperative. Therefore, policymakers of country 1 choose the tax rate on consumption γ_3 which maximizes the utility function of the representative consumer of that country, taking as given the consumption tax rate γ_4^* , and the cooperative tariff rates (t_4, t_3^*) . In the same way, policymakers of country 2 choose γ_4^* taking as given γ_3 and (t_4, t_3^*) . And the tariff rates (t_4, t_3^*) are set cooperatively by some institution which maximizes the sum of the utilities $u + u^*$ of the representative consumers of the two countries, taking as given γ_3 and γ_4^* .

As shown in Appendix 3, the first best solution is attained as an equilibrium of such a game. The optimum unemployment is reached and consumption and trade are subsidized with the amounts of subsidies being all equal to the cooperative production subsidies studied in Section 4 above. We have at the equilibrium :

$$\gamma_3^e = \gamma_4^{*e} = t_4^e = t_3^{*e} = \eta_3^c = \eta_4^{*c} < 0$$

where the index "e" refer to the equilibrium just considered and where η_3^c and η_4^{*c} are the cooperative subsidies on outputs of the Eastern sectors found in Section 4.

Therefore, in our model, it is enough for countries to cooperate when subsidizing trade with each other, in order to reach the first best

solution. The other component of the optimal policy package (consumption subsidies) can be non-cooperative. This specific result may depend on the assumptions of our model and especially the ones concerning the impediments to intersectoral adjustment during the transition period. Nonetheless, it has the merit of underlying the usefulness for Eastern countries to cooperate in their mutual trade relationships.

It can also be checked (see Appendix 3) that if countries did not cooperate when choosing the tariff rates (t_4, t_3^*) , the first best solution could not be attained. In that sense, such a cooperation is also necessary.

7. LIBERALIZATION OF IMPORTS FROM THE WEST AS AN ENDOGENOUS VARIABLE

In our analysis we have assumed that trade liberalization with the West consisted in going from positive tariff rates $(\bar{t}_2 = \bar{t}_2^* > 0)$ to zero tariff rates $(t_2 = t_2^* = 0)$ on imports from the West. In this section we will try to make the policy of liberalization of imports from the West endogenous. In this way we can raise the issue of the optimal degree of trade liberalization.

First we should note that a zero tariff rate on imports from the West, which has been our assumption until now, is optimal in the long-run but also in the adjustment period when the first best solution is reached. This is simply the consequence of the traditional theory of domestic distortions to which we referred in Section 4. This means that a zero tariff rate on imports from the West would be optimal during the adjustment period if countries cooperatively subsidized the outputs of the Eastern sectors (see Section 4) or, alternatively, if they cooperatively subsidized trade between themselves (see Section 6).

When the first best solution is not attained, however, second best theory tells us that free trade with the West would not be optimal. This may give some justification to the argument that trade with the West should only be progressively liberalized²⁰. To better understand what is involved here, consider the simple case where there are no other policy instrument available to policymakers. Then, the model is the one given

in Section 3 (when (14) and (15) hold instead of (1) of (2)). As before, we can look at both the cooperative solution and the non-cooperative equilibrium during the adjustment period. The formal analysis is done in Appendix 4. First, we find that, at both types of solutions, the tariff rates should be positive :

$$(35) \quad t_2^C = t_2^{*C} > 0$$

$$(36) \quad t_2^{NC} = t_2^{*NC} > 0$$

Inequality (35) confirms the intuition that full trade liberalization with the West would not be optimal. Inequality (33) shows that even if they do not cooperate, countries would not completely liberalize. Therefore, contrary to what happens for the policy variables considered in the previous sections, the lack of cooperation between countries can never make things worse than the situation depicted in Section 3 with no policy response and $t_2 = t_2^* = 0$.

Another result we obtain is that, when countries cooperate, unemployment may be higher than the minimal level required for the intersectoral transfer of labor (we may have $\bar{q}_3 - q_3 > N$) which is at variance with what we obtained before. This occurs because higher tariff rates would imply greater price distortions which may yield welfare losses superior to the welfare gains associated with lower unemployment. The reason is that the effect of such tariffs on the demand for Eastern goods, and therefore on unemployment, may not be large enough to make it worthwhile to reduce unemployment through higher tariff rates.

Finally, if we compare the non-cooperative equilibrium to the cooperative solution, we find that the absence of cooperation tends to make the equilibrium tariff rates too low. When countries do not cooperate, trade with the West would be liberalized too much. More precisely, as indicated in Appendix 4, we show that the welfare of each Eastern European country would be improved if, starting from the non-cooperative equilibrium, tariff rates were marginally increased. In the case of CES utility functions, we can show that this translates into $t_2^{NC} \leq t_2^C$. As in the case of subsidies to Eastern trade, this implies a

level of unemployment which is too large and also a too large decline of Eastern trade. For, both the larger unemployment and the substitution effect tend to work into the same direction. This clearly appears if we write

$$e_4^C - e_4^{NC} = \int_{t_2^{NC}}^{t_2^C} e_{42} dt_2 + \int_{u^{NC}}^{u^C} e_{4u} du \geq 0$$

the inequality follows from the assumptions (12) and (13), the inequality $u^{NC} \leq u^C$ (by definition of the cooperative solution), and the inequality $t_2^{NC} \leq t_2^C$.

8. SUMMARY AND CONCLUSION

We have underlined that the policy of liberalization of imports from the West followed by Eastern European countries, implies too much unemployment and a too large decline of their mutual trade during the adjustment process. As goods previously traded with other Eastern European countries ("Eastern goods") cannot be sold to the West, and as labor cannot immediately be transferred to the sector of production of goods that are exportable to the West, liberalization of imports from the West, which decreases the demand for Eastern goods, creates an excess supply of these goods. In the presence of relative real wage rigidities, this creates unemployment. Although there exists some amount of unemployment required for the intersectoral transfer of labor, two factors tend to make the actual level of unemployment greater than this required level. First, unemployment reduces the demand for Eastern goods in any period of adjustment below its long-run level (where unemployment would have disappeared). Second, during the adjustment process, which may take a rather long time, the necessary amount of unemployment in each period is smaller than the total amount of labor which has to be transferred until the long-run is attained.

To reduce or even avoid the inefficiency created by unnecessary unemployment, policymakers of these countries could engage in corrective policies. Going to the source of the distortion that creates

the inefficiency (relative real wage rigidity) would be the first best policy. In our model this would amount to subsidizing the output of the Eastern sector in each country. However, this would implicitly assume that such a policy is cooperatively set by the policymakers of the two countries. But it is likely that Eastern European countries would actually not cooperate when they decide on their policies of subsidies to the Eastern sector. We therefore have to take into account the additional inefficiencies created by non-cooperative behavior. The outcome could actually be even worse, leading to still more unemployment.

In the same way, if Eastern European countries try to subsidize their mutual trade, through import or export subsidies, the outcome would be favorable in the case these countries cooperate. If they do not, the result could also be worse, leading to additional unemployment and an even larger decline of their mutual trade. On that last point we have also pointed out that such an additional inefficiency might show up as overshooting of trade shares.

As usual, the reason lies in the externalities between countries that such policies imply. Here they work through two kinds of channels. One concerns the terms of trade. A country is reluctant to subsidize output or trade because it may deteriorate its terms of trade. In the non-cooperative case, the beneficial effect on the welfare of the other country due to the change in the terms of trade is not taken into account. The second channel goes through the effect on unemployment. The favorable effect of subsidies on the unemployment of the other country is not taken into account when countries do not cooperate. These two kinds of externalities imply that policymakers would set too low subsidies or would even put taxes.

While such kinds of inefficiencies due to the lack of cooperation between countries are well known in the literature, it should be emphasized that, in the present context, they may look less conspicuous than in the usual case where they rather lead to tariff wars²¹. For, these inefficiencies do not necessarily translate into high tariffs or taxes. In fact, as we have shown, they may lead to too low subsidies or

to free trade. On that point, it should be noted that in the case of subsidies or taxes on imports, the beneficial effects of free trade through reduced price distortions perversely work here. For, this tends to create unnecessary unemployment in the other country, and such an effect is not taken into account at the non-cooperative equilibrium.

Although cooperative subsidies to trade between Eastern European countries would be beneficial, they do not lead per se to the first best solution. However, we have shown that, in our model, such a first best solution could be attained without any additional cooperation between countries. These countries should simply, in a decentralized way, add to the policy package a policy of subsidies to the domestic consumption of the domestically produced Eastern goods. Externalities between countries arising from such subsidies to consumption are small enough to imply no inefficiency in our model.

When the first best solution is not attained, it may be better for Eastern European countries to liberalize their imports from the West only gradually. Here also, however, the lack of cooperation between countries may involve inefficiencies. Countries would liberalize their imports from the West too much. This would translate into more unemployment and a too large decline in their mutual trade.

As a policy implication, these results call for more cooperation between countries of Eastern Europe. But we have also more particularly underlined the importance for them to cooperate in their mutual trade relationships. They should cooperatively set up a system of subsidies which would increase their mutual trade and eliminate unnecessary unemployment.

Thus, contrary to some proposals²², what is needed is not a free trade area between these countries. In our framework, a free trade area may eliminate part of the inefficiencies if the non-cooperative equilibrium involves positive taxes on trade. But it would not go far enough because subsidies are actually required.

A final remark, however, is in order. A cooperative system of subsidies to trade between Eastern European countries is only necessary during the adjustment period. The magnitude of subsidies should decrease as time goes on, and in the longer run, such a system should completely disappear. This has to be kept in mind when we consider that Eastern European countries seem quite opposed to policy proposals which tend to favor their mutual trade. They fear that this may prevent their integration with the Western world. Such a fear may be justified if, as it may be the case in the real world, there is a tendency for such a system to stay in place in the longer run. Being transitory and decreasingly important through time, is therefore a feature of the system which should be strongly emphasized.

A P P E N D I X

1. Subsidizing the output of the Eastern sector

From (22), (3) and (9) we get

$$(A1a) \quad e(p, u) = \bar{q}_1 + (1+\eta_3) [e_3(p, u) + e_3^*(p^*, u^*)]$$

$$(A1b) \quad e^*(p^*, u^*) = \bar{q}_1 + (1+\eta_4^*) [e_4(p, u) + e_4^*(p^*, u^*)]$$

Differentiating (A1a), and using (21), we get

$$\begin{aligned} e_3 d\eta_3 + e_4 d\eta_4^* + e_u du &= (1+\eta_3) (e_{33} d\eta_3 + e_{34} d\eta_4^* + e_{3u} du + e_{33}^* d\eta_3 \\ &\quad + e_{34}^* d\eta_4^* + e_{3u}^* du^*) + (e_3 + e_3^*) d\eta_3 \end{aligned}$$

where $e_u \equiv \frac{\partial e}{\partial u}$. This equality can be rewritten

$$\begin{aligned} \left[e_u - (1+\eta_3) e_{3u} \right] du - (1+\eta_3) e_{3u}^* du^* &= \left[(1+\eta_3)(e_{33} + e_{33}^*) + e_3 \right] d\eta_3 \\ &\quad + \left[(1+\eta_3)(e_{34} + e_{34}^*) - e_3 \right] d\eta_4^* \end{aligned}$$

In the same way, differentiating (A1b) gives

$$\begin{aligned} \left[e_u^* - (1+\eta_4^*) e_{4u}^* \right] du^* - (1+\eta_4^*) e_{4u} du &= \left[(1+\eta_4^*)(e_{44}^* + e_{44}) + e_4 \right] d\eta_4^* \\ &\quad + \left[(1+\eta_4^*)(e_{43}^* + e_{43}) - e_4^* \right] d\eta_3 \end{aligned}$$

Because of the symmetry of the model with respect to the two countries, we look for solutions such that $\eta_3 = \eta_4^*$. Then using the symmetry relationship (5) we get

$$\begin{aligned} \left[e_u^{-(1+\eta_3)} e_{3u} \right] du - (1+\eta_3) e_{4u} du^* &= \left[(1+\eta_3)(e_{33} + e_{44}) + e_4 \right] d\eta_3 \\ &+ \left[(1+\eta_3)(e_{34} + e_{43}) - e_4 \right] d\eta_4^* \end{aligned}$$

$$\begin{aligned} \left[e_u^{-(1+\eta_3)} e_{3u} \right] du^* - (1+\eta_3) e_{4u} du &= \left[(1+\eta_3)(e_{33} + e_{44}) + e_4 \right] d\eta_4^* \\ &+ \left[(1+\eta_3)(e_{34} + e_{43}) - e_4 \right] d\eta_3 \end{aligned}$$

This gives

$$du = \frac{1}{D_1} (\rho d\eta_3 + \varepsilon d\eta_4^*)$$

$$du^* = \frac{1}{D_1} (\varepsilon d\eta_3 + \rho d\eta_4^*)$$

where

$$(A2) \quad D_1 = \left[e_u^{-(1+\eta_3)} e_{3u} - (1+\eta_3) e_{4u} \right] \left[e_u - (1+\eta_3) e_{3u} + (1 + \eta_3) e_{4u} \right]$$

$$\begin{aligned} (A3) \quad \rho &= \left[e_u^{-(1+\eta_3)} e_{3u} \right] \left[(1+\eta_3)(e_{33} + e_{44}) + e_4 \right] \\ &+ (1+\eta_3) e_{4u} \left[(1+\eta_3) 2e_{34} - e_4 \right] \end{aligned}$$

$$\begin{aligned} (A4) \quad \varepsilon &= \left[e_u^{-(1+\eta_3)} e_{3u} \right] \left[(1+\eta_3) 2e_{34} - e_4 \right] \\ &+ (1+\eta_3) e_{4u} \left[(1+\eta_3)(e_{33} + e_{44}) + e_4 \right] \end{aligned}$$

Note that we have $D_1 > 0$. For, as $e(p,u)$ is homogenous of degree one in p we can write

$$e(p,u) = \sum_{i=1}^4 p_i e_i$$

Then, taking the partial derivative of each member of this equality with respect to u gives

$$(A5) \quad e_u = \sum_{i=1}^4 p_i e_{iu}$$

Using (21) this gives

$$e_u = e_{1u} + e_{2u} + (1+\eta_3) e_{3u} + (1+\eta_3) e_{4u}$$

and therefore we have

$$D_1 = (e_{1u} + e_{2u}) [e_{1u} + e_{2u} + 2(1+\eta_3) e_{4u}] > 0$$

The cooperative solution is obtained by maximizing $u+u^*$ under the constraints (11a) and (11b). We have

$$\frac{\partial(u+u^*)}{\partial \eta_3} = \frac{1}{D_1} (\rho + \epsilon)$$

Using (A5) and the expressions giving D_1 , ϵ and γ above, we get

$$\frac{\partial(u+u^*)}{\partial \eta_3} = \frac{1}{e_{1u} + e_{2u}} (1+\eta_3) (e_{33} + e_{44} + 2e_{34})$$

We know that the Slutsky substitution matrix (e_{ij}) is negative semi-definite. This implies $e_{33} e_{44} \geq (e_{34})^2$ which in its turn implies $(e_{33} + e_{44})^2 \geq 4e_{34}^2$, and consequently

$$e_{33} + e_{44} + 2 e_{34} \leq 0$$

This inequality implies

$$\frac{\partial(u+u^*)}{\partial\eta_3} \leq 0$$

Therefore, it is optimal to subsidize production of the Eastern sector as much as it is possible. This occurs until the constraints (11a) and (11b) become binding. (When $\eta_3 = \eta_4^*$ and $d\eta_3 = d\eta_4$ we can write $\frac{dq_3}{d\eta_3} = e_{33} + e_{44} + (e_{3u} + e_{4u}) \frac{du}{d\eta_3}$, which is negative as we have $du/d\eta_3 = \partial(u+u^*)/\partial\eta_3$ when $d\eta_3 = d\eta_4^*$). The cooperative solution therefore involves unemployment equal to its minimal amount.

The non-cooperative Nash equilibrium is obtained when country 1 maximizes u under the constraint (11a), taking η_4^* as given, and country 2 maximizes u^* under the constraint (11b) taking η_3 as given. We have obtained

$$\frac{\partial u}{\partial\eta_3} = \frac{\rho}{D_1}$$

Using (A3) and noting that we have $D_1 > 0$, $e_u > 0$ and $e_{33} + e_{44} < 0$, this partial derivative has the sign of

$$\begin{aligned} - \frac{\rho}{e_u(e_{33}+e_{44})} &= \left[1 - (1+\eta_3) \frac{e_{3u}}{e_u} \right] \left[- (1 + \eta_3) - \frac{e_4}{e_{33}+e_{44}} \right] \\ &\quad + (1+\eta_3) \frac{e_{4u}}{e_u} \left[- (1 + \eta_3) \frac{2e_{34}}{e_{33}+e_{44}} + \frac{e_4}{e_{33}+e_{44}} \right] \end{aligned}$$

Using (21) and the expressions given in Appendix 5 for the CES utility function (23), we obtain, after calculus, that this expression has the same sign as

$$f(\sigma, \eta_3) \equiv \left[\left(\frac{\alpha_4}{\alpha_3} + 3 \right) (1-\sigma) - 2 \right] \alpha_4 (1+\eta_3)^{1-\sigma} + \left(\frac{\alpha_4}{\alpha_3} + 1 \right) (1-\sigma) - 1$$

In the case $\alpha_3 = \alpha_4$ (i.e. $\lambda_3 = \lambda_4$), we see that when we have $\sigma > 1/2$

we have $f(\sigma, \eta_3) < 0$, and therefore $\partial u / \partial \eta_3 < 0$, for all η_3 . Then, it is always good to subsidize the output until the constraints (11a) and (11b) become binding. (Note that we have

$$\frac{\partial q_3}{\partial \eta_3} = e_{33} + e_{44} + e_{3u} \frac{\partial u}{\partial \eta_3} + e_{4u} \frac{\partial u^*}{\partial \eta_3}, \text{ which, in the case } \alpha_3 = \alpha_4$$

and consequently $e_{3u} = e_{4u}$, is obviously negative because we have $\partial(u+u^*)/\partial \eta_3 < 0$). Therefore we obtain the cooperative solution, where unemployment is optimal. However, when we have $\sigma < 1/2$, we get $f(\sigma, \eta_3) > 0$, and therefore $\partial u / \partial \eta_3 > 0$ for all η_3 . In the case $\sigma = 1/2$ we get $f(\sigma, \eta_3) = 0$, and therefore $\partial u / \partial \eta_3 = 0$ for all η_3 .

2. Subsidizing trade between Eastern European countries

2.1. Import subsidies

From (25), (3) and (9) we get

$$e(p, u) = \bar{q}_1 + e_3(p, u) + e_3^*(p^*, u^*) + t_4 e_4(p, u)$$

$$e^*(p^*, u^*) = \bar{q}_1 + e_4(p, u) + e_4^*(p^*, u^*) + t_3^* e_4^*(p^*, u^*)$$

Differentiating these equations as in Appendix 1 and using (24), we find after calculus, looking for solutions such that $t_4 = t_3^*$ and using the symmetry relationship (5) :

$$du = \frac{1}{D_2} (\alpha dt_4 + \beta dt_3^*)$$

$$du^* = \frac{1}{D_2} (\beta dt_4 + \alpha dt_3^*)$$

$$(A6) D_2 = (e_{1u} + e_{2u})(e_{1u} + e_{2u} + 2e_{4u})$$

$$(A7) \alpha = - (e_{1u} + e_{2u} + e_{4u})(e_{41} + e_{42} + e_{44}) + e_{4u} e_{44}$$

$$(A8) \beta = (e_{1u} + e_{2u} + e_{4u}) e_{44} - e_{4u}(e_{41} + e_{42} + e_{44})$$

Note that in order to get these expressions, we have used (A5) which, according to (24), gives

$$e_u = e_{1u} + e_{2u} + e_{3u} + (1+t_4) e_{4u}$$

We have also used the fact that $e_i(p,u)$ is homogenous of degree zero with respect to p , which gives

$$(A9) \quad \sum_{j=1}^4 p_j e_{ij} = 0 \quad i = 1, 2, 3, 4$$

We have actually used such an equality for $i = 4$, which using (24) can be written

$$e_{41} + e_{42} + e_{43} + (1+t_4) e_{44} = 0$$

For the cooperative solution we consider

$$\frac{\partial(u+u^*)}{\partial t_4} = \frac{\alpha + \beta}{D_1}$$

Using (A6)-(A8) this gives (26) in the text.

We also have $\frac{dq_3}{dt_4} < 0$ when $t_4 = t_3^*$ and $dt_4 = dt_3^*$. For, using (5) and the fact that in that case $\frac{du}{dt_4} = \frac{du^*}{dt_4} = \frac{\alpha + \beta}{D_1} = \frac{\partial(u+u^*)}{\partial t_4}$, we can write

$$\frac{dq_3}{dt_4} = e_{33} + e_{44} + 2e_{34} + (e_{3u} + e_{4u}) \frac{\partial(u+u^*)}{\partial t_4}$$

Using (26) this is negative because, as indicated in Appendix 1, the fact that the Slutsky substitution matrix is negative semi-definite implies $e_{33} + e_{44} + 2e_{34} \leq 0$.

Note that, as there is excess unemployment when $t_4 = 0$ and as we have $dq_3/dt_4 < 0$, this implies $t_4^C < 0$ at the cooperative solution.

For the non-cooperative equilibrium we consider $\partial u / \partial t_4$ which is equal to α . If the binding constraint (11a) is not active, leading to an equilibrium different from the cooperative solution, we should have $\partial u / \partial t_4 = \alpha = 0$. From (A7) the condition $\alpha = 0$ can also be written

$$1 + \frac{e_{41} + e_{42}}{e_{44}} \left(1 + \frac{e_{4u}}{e_{1u} + e_{2u}}\right) = 0$$

In the case of a CES utility function, using the formulae in Appendix 5, this equation reduces to

$$(A10) \quad g(1+t_4) \equiv 1 - \frac{\alpha_1 + \alpha_2}{\alpha_1 + \alpha_2 + \alpha_3} (1+t_4) - \frac{\alpha_4}{\alpha_1 + \alpha_2 + \alpha_3} (1+t_4)^{1-\sigma} = 0$$

In the case $\sigma \leq 1$ we can easily see that $g(1+t_4)$ is a decreasing function of $1+t_4$ which is positive for $1+t_4=0$ and negative for $1+t_4$ going to infinity. Therefore there is a unique solution $\tilde{t}_4^{NC}$ to equation (A10). When $\tilde{t}_4^{NC}$ is greater than the value for which the constraint (11a) becomes binding (which is also the value t_4^C at the cooperative solution), there is some inefficiency created by the absence of cooperation. It can be seen from (A10) that $\tilde{t}_4^{NC}$ has the sign of $\alpha_3 - \alpha_4$ and therefore of $\lambda_3 - \lambda_4$. As a consequence, when $\lambda_3 \geq \lambda_4$ we must have $\tilde{t}_4^{NC} \geq 0 > t_4^C$, because we have $t_4^C < 0$.

2.2. Export subsidies

(28), (3) and (9) yield

$$e(p, u) = \bar{q}_1 + e_3(p, u) + (1+\theta_3) e_3^*(p^*, u^*)$$

$$e^*(p, u) = \bar{q}_1 + e_4^*(p^*, u^*) + (1+\theta_4^*) e_4(p, u)$$

As in Appendix 1, differentiating and using (27), looking for solutions such that $\theta_3 = \theta_4^*$, and using (5) we find

$$du = \frac{1}{D_3} (\gamma d\theta_3 + \delta d\theta_4^*)$$

$$du^* = \frac{1}{D_3} (\delta d\theta_3 + \gamma d\theta_4^*)$$

where

$$D_3 = (e_{1u} + e_{2u}) [e_{1u} + e_{2u} + 2(1+\theta_3) e_{4u}]$$

$$\gamma = (e_u - e_{3u}) [(1+\theta_3) e_{44} + e_4] - (1+\theta_3) e_{4u} (e_4 - e_{34})$$

$$\delta = - (e_u - e_{3u}) (e_4 - e_{34}) + (1+\theta_3) e_{4u} [(1+\theta_3) e_{44} + e_4]$$

Using (27) and (A9) for $i = 4$, we can check that $(\gamma + \delta)/D_3$ is equal to $(\alpha + \beta)/D_2$, leading to the same cooperative solution.

For the non-cooperative equilibrium we can see that $\frac{\partial u}{\partial \theta_3} = \gamma/D_3$ has the sign of

$$- \frac{\gamma}{e_u e_{44}} = - \left(1 - \frac{e_{3u}}{e_u}\right) \left[(1+\theta_3) + \frac{e_4}{e_{44}}\right] + (1 + \theta_3) \frac{e_{4u}}{e_u} \left(\frac{e_4 - e_{34}}{e_{44}}\right)$$

In the case of the CES utility function, using Appendix 5, we find after calculus that this expression becomes

$$- \frac{\gamma}{e_u e_{44}} = \frac{1-\sigma}{\sigma} \frac{\alpha_1 + \alpha_2}{\alpha_1 + \alpha_2 + \alpha_3 + \alpha_4 (1+\theta_3)^{1-\sigma}} (1+\theta_3) \left[1 + \frac{\alpha_4}{\alpha_1 + \alpha_2 + \alpha_3} (1+\theta_3)^{1-\sigma}\right]$$

Therefore, $\partial u / \partial \theta_3$ has the sign of $1-\sigma$. In the case $\sigma < 1$ it is always beneficial for any country to increase its export taxes ($\partial u / \partial \theta_3 > 0$). We can check we have $\partial q_3 / \partial \theta_3 < 0$ in that case, so that the optimal unemployment solution cannot be an equilibrium, first order conditions being not satisfied. For, we can write

$$\frac{\partial q_3}{\partial \theta_3} = e_{44} + e_{4u} \frac{\partial u^*}{\partial \theta_3}$$

$$\text{But we have } \frac{\partial u^*}{\partial \theta_3} = \frac{\partial(u+u^*)}{\partial \theta_3} - \frac{\partial u}{\partial \theta_3} < 0$$

(as we have seen before, we have $\frac{\partial(u+u^*)}{\partial \theta_3} = \frac{\partial(u+u^*)}{\partial t_4} < 0$, and we are in a case where $\partial u / \partial \theta_3 > 0$).

This implies $\partial q_3 / \partial \theta_3 < 0$.

3. Subsidizing consumption of Eastern goods

We will consider directly the more general system $\{(33), (34)\}$, the system $\{(29), (30)\}$ being obtained in the special case $t_4 = t_3^* = 0$. This system gives the following equations

$$e(p, u) = \bar{q}_1 + (1+\gamma_3) e_3(p, u) + t_4 e_4(p, u) + e_3^*(p^*, u^*)$$

$$e^*(p^*, u^*) = \bar{q}_1 + (1+\gamma_4^*) e_4^*(p^*, u^*) + t_3^* e_3^*(p^*, u^*) + e_4(p, u)$$

We differentiate these equations in the same way as in Appendix 1, and use (A5) and (A9) for $i=3$ and $i=4$, which using (30) gives

$$(A11) \quad e_u = e_{1u} + e_{2u} + (1+\gamma_3) e_{3u} + (1+t_4) e_{4u}$$

$$(A12) \quad e_{31} + e_{32} + (1+\gamma_3) e_{33} + (1+t_4) e_{34} = 0$$

$$(A13) \quad e_{41} + e_{42} + (1+\gamma_3) e_{43} + (1+t_4) e_{44} = 0$$

We obtain

$$(A14a) \quad du = \frac{1}{D_2} (v d\gamma_3 + \xi d\gamma_4^* + \alpha dt_4 + \beta dt_3^*)$$

$$(A14b) \quad du^* = \frac{1}{D_2} (\xi d\gamma_3 + v d\gamma_4^* + \beta dt_4 + \alpha dt_3^*)$$

where D_2 , α and β are given by the same formal expressions as in (A6), (A7) and (A8) (although they are not equal because p , p^* , u and u^* are different), and where ν and ξ are given by

$$(A15) \quad \nu = -(e_{1u} + e_{2u} + e_{4u})(e_{31} + e_{32} + e_{34}) + e_{4u} e_{43}$$

$$(A16) \quad \xi = (e_{1u} + e_{2u} + e_{4u}) e_{43} - e_{4u}(e_{31} + e_{32} + e_{34})$$

Consider first the cooperative solution. We have

$$\frac{\partial(u+u^*)}{\partial\gamma_3} = \frac{\nu+\xi}{D_2}$$

Using (A6), (A15) and (A16) this gives (31) in the text (which is therefore also valid in the case $t_4 = t_3^* \neq 0$). For the optimal unemployment solution to be the cooperative solution we have to check that we have $dq_3/d\gamma_3 < 0$ when $d\gamma_3 = d\gamma_4^*$ (and of course $\gamma_3 = \gamma_4^*$). We can write, using the symmetry assumption (5) :

$$(A17) \quad dq_3 = e_{33} d\gamma_3 + e_{34} dt_4 + e_{3u} du + e_{44} dt_3^* + e_{43} d\gamma_4^* + e_{4u} du^*$$

Making $d\gamma_4^* = d\gamma_3$ and $dt_4 = dt_3^* = 0$, we get

$$(A18) \quad \frac{dq_3}{d\gamma_3} = e_{33} + e_{43} + (e_{3u} + e_{4u}) \frac{\partial(u+u^*)}{\partial\gamma_3}$$

$$(\text{when } d\gamma_4^* = d\gamma_3 \text{ we have } \frac{du}{d\gamma_3} = \frac{du^*}{d\gamma_3} = \frac{\partial(u+u^*)}{\partial\gamma_3})$$

But from (A12) we get

$$e_{33} + e_{43} = -(e_{31} + e_{32} + \gamma_3 e_{33} + t_4 e_{34})$$

In the case where a priori we have $t_4 = 0$ we get $e_{33} + e_{43} < 0$ when $\gamma_3 < 0$, which is satisfied when unemployment is optimal.

In the case of the first best solution where $t_4 = \gamma_3$ we get

$$e_{44} + e_{43} = - [e_{31} + e_{32} + \gamma_3(e_{33} + e_{34})]$$

which yields

$$e_{33} + e_{43} = - \frac{e_{31} + e_{32}}{1 + \gamma_3} < 0$$

Therefore, in both cases we have

$$(A19) \quad e_{33} + e_{34} < 0$$

From (31), (A18) and (A19), we obtain $dq_3/d\gamma_3 < 0$

When the choice of γ_3 and γ_4^* is non-cooperative we consider

$$\frac{\partial u}{\partial \gamma_3} = \frac{\nu}{D_2}$$

Using (A12) in the case where a priori $t_4=0$, this gives (32) in the text.

In the case of the first best solution, we make $\gamma_3=t_4$ in (A12), which gives

$$\frac{\partial u}{\partial \gamma_3} = \frac{(e_{1u}+e_{2u})[e_{33}+\gamma_3(e_{33}+e_{34})] - e_{4u}(e_{31}+e_{32})}{(e_{1u}+e_{2u})(e_{1u}+e_{2u}+2e_{4u})} < 0$$

where we have used (A19) to show the inequality. This leads to the optimal unemployment level (which in the case of the first best solution eliminates any incentive to deviate from this solution). We have, however, to check that $\partial q_3/\partial \gamma_3 < 0$ holds. To see that, make $d\gamma_4^*=dt_4=dt_3^*=0$ in (A17). We get

$$\frac{\partial q_3}{\partial \gamma_3} = e_{33} + e_{3u} \frac{\partial u}{\partial \gamma_3} + e_{4u} \frac{\partial u^*}{\partial \gamma_3} = e_{33} + e_{3u} \frac{\nu}{D_2} + e_{4u} \frac{\xi}{D_2}$$

Using (A6), (A15), (A16) and the inequality (A19), we obtain

$$(A20) \quad e_{33} D_2 + e_{3u} \nu + e_{4u} \xi < 0$$

and consequently $\partial q_3 / \partial \gamma_3 < 0$.

Finally, we can show that when the choice of (t_4, t_3^*) is non-cooperative, then the first best solution cannot be attained. The strategies of the policymakers of country 1 are now (γ_3, t_4) , and they take (γ_4^*, t_3^*) as given. As we still have $\partial u / \partial \gamma_3 < 0$, the optimal unemployment is still attained. However, there is now an incentive for policymakers of country 1 to increase t_4 above its first best value. To prove that, we will show that we have $du / dt_4 > 0$ at this first best, where du / dt_4 is calculated by assuming that $d\gamma_3$ varies optimally, which, as we have just seen, means that the optimal unemployment is maintained. Making $dt_3^* = d\gamma_3^* = 0$ and $dq_3 = 0$ in (A17), we get

$$dq_3 = e_{33} d\gamma_3 + e_{34} dt_4 + e_{3u} du + e_{4u} du^* = 0$$

Substituting the expression giving du and du^* and solving, we obtain

$$(A21) \quad d\gamma_3 = - \frac{e_{34} D_2 + e_{3u} \alpha + e_{4u} \beta}{e_{33} D_2 + e_{3u} \nu + e_{4u} \xi}$$

From (A14a) we have

$$du = \frac{\nu}{D_2} d\gamma_3 + \frac{\alpha}{D_2} dt_4$$

which using (A21) gives

$$du = \frac{1}{D_2} \left[-\nu \frac{e_{34} D_2 + e_{3u} \alpha + e_{4u} \beta}{e_{33} D_2 + e_{3u} \nu + e_{4u} \xi} + \alpha \right]$$

To simplify the calculus take the case $e_{3u} = e_{4u}$, $e_{31} = e_{41}$, and $e_{32} = e_{42}$ (which occurs when the representative individuals of the two

countries have the same tastes). Then using inequality (A20), this expression has the sign of A defined by

$$A \equiv -v(e_{33} - e_{34}) - (\alpha - \xi) [e_{33} + e_{3u} \frac{v + \xi}{D_2}]$$

Using (A6), (A15) and (A16), this expression reduces to

$$A = (e_{33} - e_{44})^2 (e_{1u} + e_{2u}) > 0$$

which yields $\frac{du}{dt_4} > 0$

4. Liberalization of imports from the West as an endogenous variable

Equations (15), (34) and (9) give

$$e(p, u) = \bar{q}_1 + e_3(p, u) + e_3^*(p^*, u^*) + t_2 e_2(p, u)$$

$$e^*(p^*, u^*) = \bar{q}_1 + e_4(p, u) + e_4^*(p^*, u^*) + t_2^* e_2^*(p^*, u^*)$$

Using (14) and (A5) and differentiating in the same way as in Appendix 1, we get

$$(A22a) \quad du = \frac{1}{D_2} (\lambda dt_2 + \mu dt_2^*)$$

$$(A22b) \quad du^* = \frac{1}{D_2} (\mu dt_2 + \lambda dt_2^*)$$

where the formal expression of D_2 is given by (A6), and λ and μ are given by

$$(A23) \quad \lambda = (e_{1u} + e_{2u} + e_{4u}) (e_{23} + t_2 e_{22}) + e_{4u} e_{24}$$

$$(A24) \quad \mu = (e_{1u} + e_{2u} + e_{4u}) e_{24} + e_{4u} (e_{23} + t_2 e_{22})$$

Before we consider in more details the cooperative and non-cooperative solutions, let us remark that if we make the additional

assumption that utility functions are homothetic, the inequality $dq_3/dt_2 > 0$ when $t_2 = t_2^*$ and $dt_2 = dt_2^*$, also holds in the short-run (in Section 3 this was assumed to hold in the long-run). For, when $dt_2 = dt_2^*$ we have $du/dt_2 = \frac{\lambda + \mu}{D_2} = \frac{e_{23} + e_{24} + t_2 e_{22}}{e_{1u} + e_{2u}}$, which implies

$$(A25) \quad \frac{dq_3}{dt_2} = e_{23} + e_{24} + \frac{e_{3u} + e_{4u}}{e_{1u} + e_{2u}} (t_2 e_{22} + e_{23} + e_{24})$$

From (A25) we see that the condition $dq_3/dt_2 > 0$ is actually formally equivalent to (18). However the e_{1j} and e_{1u} depend on (p, u) . But the price vector is the same in the short-run and in the long-run. Furthermore if we assume that utility functions are homothetic, we can write $e(p, u) = \hat{e}(p)u$, where $\hat{e}(\cdot)$ is an increasing homogenous of degree one and concave function of p . But inequality (18) is equivalent to

$$- \frac{e_{23} + e_{24}}{e_{22}} (e_{1u} + e_{2u} + e_{3u} + e_{4u}) - (e_{3u} + e_{4u}) t_2 > 0$$

As we have $e_{1j}(p, u) = \hat{e}_{1j}(p)u$ and $e_{1u} = \hat{e}_1(p)$, this inequality does not depend on u . Therefore, we obtain exactly the same condition in the long-run and in the short-run.

For the cooperative solution we have

$$\frac{\partial(u+u^*)}{\partial t_2} = \frac{\lambda + \mu}{D_2} = \frac{e_{23} + e_{24} + t_2 e_{22}}{e_{1u} + e_{2u}}$$

Consequently, the value $\tilde{t}_2^C$ which makes $\frac{\partial(u+u^*)}{\partial t_2} = 0$ satisfies

$$\tilde{t}_2^C = - \frac{e_{23} + e_{24}}{e_{22}} > 0$$

Call $\bar{t}_2$ the value of t_2 such that unemployment is just equal to its minimum value N .

As we have $q_3^L < \bar{q}_3 - N < \bar{q}_3^0$ this implies $0 < \bar{t}_2 < \bar{t}_2^0$, where $\bar{t}_2$ decreases as $\bar{q}_2$ decreases.

The cooperative solution can be written

$$t_2^C = \min (\bar{t}_2, \tilde{t}_2^C)$$

As we have $\bar{t}_2 > 0$ this implies $t_2^C > 0$.

Note that $\tilde{t}_2^C$ does not depend on $(\bar{q}_1, \bar{q}_3)$. Therefore, if we have $\tilde{t}_2^C < \bar{t}_2^0$ we will first have excess unemployment during the adjustment process until $\bar{t}_2$ (which actually depends on time $(\bar{t}_2^t)$, as explained in Section 2) becomes lower than $\tilde{t}_2^C$ and therefore unemployment becomes equal to its minimum value. If on the contrary we have $\tilde{t}_2^C > \bar{t}_2^0$ there is no excess unemployment.

For the non-cooperative equilibrium, we consider $\frac{\partial u}{\partial t_2} = \lambda$. From (A23) the value $\tilde{t}_2^N$ such that $\frac{\partial u}{\partial t_2} = 0$ satisfies

$$\tilde{t}_2^N = - \frac{1}{e_{22}} (e_{23} + \frac{e_{4u}}{e_{1u} + e_{2u} + e_{4u}} e_{24}) > 0$$

The non-cooperative equilibrium t_2^N is equal to $\tilde{t}_2^N$ when $\tilde{t}_2^N < \bar{t}_2$, and to $\bar{t}_2$ otherwise. Therefore we have $t_2^N > 0$. In the case where we have $\tilde{t}_2^N < \bar{t}_2$, the equilibrium involves excess unemployment. The inefficiency of this equilibrium could be reduced by having a lower degree of liberalization with the West. For, it can easily be shown from (A23) and (A24) that when we have $\lambda = 0$, we also have $\mu > 0$ and therefore $\frac{\partial(u+u^*)}{\partial t_2} > 0$. In this sense, we can say that the lack of cooperation between countries involves a too large degree of trade liberalization.

The analysis can be illustrated by taking the CES utility function. Then, the equation $\lambda + \mu = 0$ which, using (A9) for $i=2$, can also be rewritten $e_{21} + e_{22} = 0$ or equivalently $-1 - \frac{e_{21}}{e_{22}} = 0$, yields (using Appendix 5)

$$(A26) \quad \tilde{t}_2^C = \frac{\alpha_3 + \alpha_4}{\alpha_1}$$

And the equation $\lambda=0$ can also be rewritten, using (A9) for $i=2$ and dividing by $-e_{22}(e_{1u}+e_{2u})$:

$$1 + \frac{e_{21} + e_{24}}{e_{22}} + \frac{e_{4u}}{e_{1u}+e_{2u}} \left(1 + \frac{e_{21}}{e_{22}}\right) = 0$$

Using Appendix 5, this yields

$$(1-\alpha_2)(\alpha_1+\alpha_4)(1+t_2)^\sigma + \alpha_2(1-\alpha_2) - \alpha_1(\alpha_1+2\alpha_4)(1+t_2)^{1+\sigma} - \alpha_2(\alpha_1+\alpha_4)(1+t_2) = 0$$

It can easily be shown that this equation has a unique solution $\tilde{t}_2^N$, and that we have $\tilde{t}_2^N < \tilde{t}_2^C$, where $\tilde{t}_2^C$ is given by (A26).

5 - The CES utility function (and Cobb-Douglas utility function)

The CES utility function is

$$u(c_1, \dots, c_n) = \left[\sum_{k=1}^n \lambda_k c_k^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \quad \sigma > 0, \quad \lambda_k > 0, \quad \sum_{k=1}^n \lambda_k = 1$$

where σ is the elasticity of substitution. This yields the expenditure function

$$e(p, u) = \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]^{\frac{1}{1-\sigma}} u$$

where we define $\alpha_k = \lambda_k^\sigma$.

This gives the following derivatives :

$$e_i(p, u) = \frac{\alpha_i}{p_i^\sigma} \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]^{\frac{\sigma}{1-\sigma}} u$$

$$e_{ij}(p,u) = \sigma \frac{\alpha_i \alpha_j}{(p_i p_j)^\sigma} \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]^{\frac{2\sigma-1}{1-\sigma}} u, \quad i \neq j$$

$$e_{ii}(p,u) = -\sigma \frac{\alpha_i}{p_i^{1+\sigma}} \left[\sum_{\substack{k=1 \\ k \neq i}}^n \alpha_k p_k^{1-\sigma} \right] \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]^{\frac{2\sigma-1}{1-\sigma}} u$$

This gives

$$(A27) \quad \frac{e_{ij}}{e_{ii}} = -p_i \frac{\alpha_j}{p_j^\sigma} \left[\sum_{\substack{k=1 \\ k \neq i}}^n \alpha_k p_k^{1-\sigma} \right]^{-1}, \quad i \neq j$$

We also have

$$(A28) \quad \frac{e_{iu}}{e_u} = \frac{e_i}{e} = \frac{\alpha_i}{p_i^\sigma} \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]^{-1}$$

and

$$(A29) \quad \frac{e_i}{e_{jj}} = -\frac{1}{\sigma} p_j \frac{\alpha_i}{p_i^\sigma} \frac{p_j^\sigma}{\alpha_j} \left[\sum_{\substack{k=1 \\ k \neq j}}^n \alpha_k p_k^{1-\sigma} \right]^{-1} \left[\sum_{k=1}^n \alpha_k p_k^{1-\sigma} \right]$$

The Cobb Douglas utility function is

$$u(c_1, \dots, c_n) = \prod_{k=1}^n c_k^{a_k}, \quad a_k > 0, \quad \sum_{k=1}^n a_k = 1$$

We actually obtain the expressions (A27), (A28) and (A29) where we make $\sigma = 1$ and $\alpha_k = a_k$.

As the formulae (A27), (A28) and (A29) will be the only ones we will use, the results we obtain for the CES utility function will also be valid in the case $\sigma = 1$ where they will correspond to the Cobb Douglas utility function.

FOOTNOTES

1. On all these points see Rodrik (1992). See also Hamilton and Winters (1992) for an estimation of long run trade flows, using a gravity model.
2. See, for example, Bofinger (1990), Kenen (1991), or Fischer (1992).
3. Of course, this statement does not apply to the present trade situation between the new Republics of the former Soviet Union, where there is limited or no convertibility, and where even a proper medium of exchange seems to be lacking (see Fischer (1992)).
4. The description of some of these agreements may be found in Nations Unies (1992).
5. For the last period of the adjustment process, we have $\bar{q}_3 - q_3^L \leq N$ and the minimum level of unemployment would be equal to $q_3^L - \bar{q}_3$. We could take this into account by substituting the value $\min(q_3^L - \bar{q}_3, N)$ to N in inequalities (11). Nothing would actually be changed in the analysis. To simplify the notation, however, we consider a "standard" period of the adjustment process where the minimum unemployment is N .
6. In the context of Eastern European countries, the implicit tariff associated with the lack of currency convertibility has been underlined by Berg and Sachs (1992). Note, however, that while in Berg and Sachs (1992) the monetary overhang was at the origin of the implicit import tax, this is not the case in our model which is entirely real.
7. For such a kind of rationalization, see for example Dixit and Norman (1980), pp.179-180.

8. From (15a) and (4a) we get

$$e(p, u) = \bar{L} + t_2 e_2(p, u)$$

Differentiating this expression we get

$$e_2 dt_2 + e_u du = e_2 dt_2 + t_2 e_{22} dt_2 + t_2 e_{2u} du$$

But we have (from (14) and (A5) in Appendix 1)

$$e_u = e_{1u} + (1+t_2) e_{2u} + e_{3u} + e_{4u}$$

This gives (17).

9. Call $x_i(p, y)$, where y is private disposable income, the Marshallian demand function for good i . Similarly to (16) we obtain

$$dq_3 = \left(\frac{\partial x_3}{\partial p_2} + \frac{\partial x_4}{\partial p_2} \right) dt_2 + \left(\frac{\partial x_3}{\partial y} + \frac{\partial x_4}{\partial y} \right) dy$$

and therefore integrating from 0 to $\bar{t}_2$ we obtain

$$\bar{q}_3^0 - q_3^L = \int_0^{\bar{t}_2} \left(\frac{\partial x_3}{\partial p_2} + \frac{\partial x_4}{\partial p_2} \right) dt_2 + \int_{y^L}^{\bar{y}^0} \left(\frac{\partial x_3}{\partial y} + \frac{\partial x_4}{\partial y} \right) dy$$

Normality of goods implies $\frac{\partial x_i}{\partial y} > 0$ while assumptions about goods being gross (Marshallian) substitutes gives $\frac{\partial x_3}{\partial p_2} > 0$ and $\frac{\partial x_4}{\partial p_2} > 0$. But now (although we have $\bar{u}^0 < u^L$) we have $\bar{y}^0 > y^L$. For, by definition of private disposable income y , we have $y = q_1 + q_3 + t_2 x_2(p, y)$, which implies

$$\begin{aligned} \bar{y}^0 &= \bar{L} + \bar{t}_2^0 x_2(p, \bar{y}^0) > \bar{L} \text{ as we have } \bar{t}_2^0 > 0 \text{ (and } x_2 > 0) \\ y^L &= \bar{L} \end{aligned}$$

Therefore we have $\bar{q}_3^0 - q_3^L > 0$.

10. We can check that inequality (18) is satisfied when we use the expressions given in Appendix 5 for the CES utility functions. Note that, although we always have $dq_3/dt_2 > 0$ even when the elasticity of substitution σ is small, the magnitude of the effect depends on σ . In the limit case where σ goes to zero, we find, that dq_3/dt_2 also goes to zero.
11. Inequalities (18) and (20) are equivalent when the representative individuals of the two countries have the same tastes. For, the equality $e^*(p_1, p_2, p_3, p_4, u) \equiv e(p_1, p_2, p_3, p_4, u)$ together with the symmetry relationship (5) implies $e(p_1, p_2, p_3, p_4, u) \equiv e(p_1, p_2, p_4, p_3, u)$ and therefore $e_{32} \equiv e_{42}$ and $e_{3u} \equiv e_{4u}$.
12. Such a proposal have indeed been made in the literature on the subject. See for example Blanchard et alii (1991).
13. The idea that policymakers of Eastern European countries could subsidize such a trade may also be found, for example, in Blanchard et alii (1991).
14. For the first order conditions to be satisfied we should however check that we have $\frac{dq_3}{dt_4} < 0$ when $t_4 = t_3^*$ and $dt_4 = dt_3^*$, which is done in Appendix 2. We also assume that when the prices $1 + t_4$ and $1 + t_3^*$ of goods 4 and 3 go to zero, the demands for imports of these goods increase sufficiently to make the total demands greater than the supplies $\bar{q}_4$ and $\bar{q}_3^*$ respectively.
15. $u^*(c_1, c_2, c_3, c_4) \equiv u(c_1, c_2, c_3, c_4)$ together with the symmetry relationship (5) implies $u(c_1, c_2, c_3, c_4) \equiv u(c_1, c_2, c_4, c_3)$, which, in the case of the CES utility function (23) gives $\lambda_3 = \lambda_4$.
16. We have in the CES case (and Cobb-Douglas case if $\sigma=1$):

$$\frac{e_4}{e_2} = \left(\frac{\lambda_4}{\lambda_2} \frac{p_2}{p_4} \right)^\sigma$$

This gives, for the initial situation, the long run, and the short run, respectively :

$$\left(\frac{\bar{e}_4}{\bar{e}_2} \right)^0 = \left(\frac{\lambda_4}{\lambda_2} \right)^\sigma \left(1 + \bar{t}_2^0 \right)^\sigma \quad \bar{t}_2^0 > 0$$

$$\left(\frac{e_4}{e_2} \right)^L = \left(\frac{\lambda_4}{\lambda_2} \right)^\sigma$$

$$\left(\frac{e_4}{e_2} \right)^S = \left(\frac{\lambda_4}{\lambda_2} \right)^\sigma \frac{1}{(1+t_4)^\sigma}$$

Therefore we have overshooting if and only if we have $t_4 > 0$ in the short run.

17. In this four-good model, the equivalence between import taxes and export taxes which holds for the standard two-good model of trade, is obviously not valid.
18. We can make the same kind of remark as in footnote 14. First, in Appendix 3 we check that we have $dq_3/d\gamma_3 < 0$, so that the first order conditions are satisfied. Second, we implicitly assume that when the prices $1+\gamma_3$ and $1+\gamma_4^*$ go to zero, the corresponding demands increase sufficiently to make demands for Eastern goods larger than supplies.
19. As shown in Appendix 3, we can check that we have $\partial q_3/\partial \gamma_3 < 0$ for γ_4^* given, so that the first order conditions of the non-cooperative equilibrium are satisfied.
20. See for example Blanchard et alii (1991).
21. A classical reference is Johnson (1954).
22. See for example Nations-Unis (1992).

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