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PIECEMEAL VERSUS PRECIPITOUS FACTOR MARKET INTEGRATION*

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The effects of the speed of international factor markets integration are studied within a general equilibrium, two country model. It is shown that even in the absence of economic frictions there can be no theoretical presumption regarding the "optimal" speed of integration. The paper identifies plausible conditions under which a precipitous pace leads to permanently lower and a piecemeal to permanently higher levels of income in the integrated economy. The analysis offers a justification based on long term economic considerations for piecemeal European Community integration practices such as transition periods, admissions phasing out, and for the precipitous German unification.

1. INTRODUCTION

The literature on the optimal speed of international economic integration (liberalization) is invariably characterized by two features: the central role placed on economic distortions; and the analytical emphasis on transitional, short-term considerations. The popular belief is that precipitous liberalization is optimal in the absence of frictions, while in their presence the optimal integration speed depends on the type of friction. If frictions take the form of adjustment costs (Leamer 1980, Mussa 1982), the a low speed may be preferable. If there are costs to moving too slowly (Bruno 1988), a high rate may fare better.[2] Furthermore, the speed of liberalization is not thought to matter much for long term prospects, if liberalization is indeed carried out.

In this paper we focus on aspects other than frictions in developing a theory of the optimal speed of integration that emphasizes *long run* issues. Such a modelling strategy does not imply that frictions and short-term costs are not of great importance for the subject (as a matter of act, the main point in this paper can be given an interpretation based on frictions). But we feel that there are other important considerations affecting the choice of the optimal speed of integration which have so far been either ignored or have not been related to long-term considerations.

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[2] The danger of credibility loss and resurging bureaucracy seems to have been a major motive behind the current precipitous measures in Poland, see Lipton and Sachs (1990).

Moreover, while for technical and practical reasons the frictions based literature has been conducted in a partial equilibrium, small open economy and often ad hoc environment (see Edwards 1989 for a review), our analysis starts from first principles, it employs a general equilibrium model involving large countries and it explicitly studies both transditional and steady state dynamics.

The model employed here has two critical features. First, it abstracts from international trade in goods by assuming the existence of a single, homogeneous international good. Hence it focuses exclusively[3] on international factor market integration. And second, following recent advances in the theory of endogenous growth (Lucas 1988) it adopts a specification that allows for multiple equilibria, each one corresponding to a different stage of economic development (Rostow 1943). In the absence of free factor movements, multiplicity implies that initial conditions determine the long run position of an economy. Some countries find themselves poor in capital and low in income, and others, in high capital intensity, high income, equilibria. Examples are the former COMECON versus the European Community (EC), and the South versus the OECD.

Our analysis identifies cases where a complete factor market liberalization can have significant, permanent, adverse effects on the level of income of the integrated economies.[4] To see how this case can arise, note that labour productivity in general depends on capital intensity and that investment depends on output. A large outflow of resources (capital) results in a decrease in both productivity and investment in the high income countries. If the resources which are transferred do not generate significant productivity gains and hence savings and capital increases in the low income countries, then capital intensity in the global economy decreases with an adverse effect on long term global productivity and income.

On the other hand, a piecemeal integration involving limited capital movements in each period may succeed where a precipitous one would have failed, provided that certain condtiions are met. First, the transferor must be productive and thrifty enough to replenish the expatriated capital sufficiently fast. Second, the foreign capital inflow into the low income country must generate sizeable out of steady state productivity and income gains so that domestic savings and investment increase significantly as a result of foreign investment. And third, the presence of certain preconditions for growth—explained in the paper—are required.[5]

[3] In an interesting paper, Rivera-Batiz and Romer (1991) investigate the issue of trade and growth and show that product trade does not enhance the growth rate but flows of ideas do. In this paper the role of trade in ideas is captured by factor movements (services), which affect labour effectiveness.

[4] With appropriate modifications, one can extend the current framework to a nonstationary one and hence discuss issues of long term endogenous growth.

[5] Our analysis also identifies situations where a gradual liberalization involving small transfers is not effective whereas a precipitous one can succeed. Such a possibility is more likely to materialize when the preconditions for growth are present but the productivity gains generated by the transfer are small, and the transferor grows relatively slowly and has a low propensity to save relative to the recipient.

The consideration emphasized in this paper, namely the behaviour of world savings, has been assigned a critical role in recent studies of East-West integration, see e.g. the CEPR (1990) report and the references therein. Two important questions have been raised in these studies. First, how much investment must flow to Eastern Europe to support a sustained, significant increase in income. And second, whether the required capital flow represents an increase in total savings in the OECD or is simply a diversion of existing savings. Our model offers a formal framework for studying questions of this type and in particular, for breaking down the total amount into required foreign investment and into savings generated within Eastern Europe. It demonstrates that steady state analysis can exaggerate the size of the required external flows and also underestimate the savings response in the OECD countries.

There are several other features of actual integration practices for which our model offers a new perspective. The gradualistic migration policies adopted by the EC in the eighties represents a good example. The conventional model explains these policies by relying on short run income distribution ad political group pressure (labour unions) considerations. We add a new dimension by suggesting that piecemeal integration may arise due to concerns about long term, national—rather than special group—welfare.

Finally, our analysis can also be used to evaluate the effects of multiple speeds. We show that a "two speed" Europe may in fact move faster than a "one speed." Rather than spreading resources symmetrically across new members, the EC can concentrate more resources on, and hence integrate faster with, the most promising ones,[6] and then use the additional resources that are generated and become available through this process to increase the rate of integration of the slow speed group.

The next section presents the model and derives formal results on the optimal speed of integration. Section 3 discusses the empirical relevance of our findings concerning actual integration practices.

2. THE MODEL

We employ a simple variant of Diamond's overlapping generations model that allows for learning by doing. For simplicity we concentrate on a two country world; the implications for multi-country environments are discussed in Section 3. Each country is populated by overlapping generations of individuals who live for two periods. Without loss of generality we assume that the size of the population is constant. For simplicity we also assume that only the young offer labour services and that their entire consumption is in the second period of their life, that is, when they are old. This leads to perfectly inelastic labour supply and saving schedules, which simplify the analysis without affecting any of the main results in the paper qualitatively. Saving takes the form of physical capital accumulation and earns a return of r. Capital is combined with labour to produce a single, homogeneous good that is the same across countries.

[6] We offer criteria for identifying "promising" countries.

Production Y is characterized by the standard neoclassical constant returns to scale technology. There are two inputs, physical capital K and effective labour aL. The linear homogeneity in these two arguments permits aggregation across firms. The aggregate production function F is given by

$$Y = F\left(K, a\left(\frac{K}{L}\right)L\right) \tag{1}$$

where L is raw labour which is premultiplied by the index of labour effectiveness $a(\cdot)$. We assume that labour effectiveness is related to learning by doing on the job and that this learning is positively related to the per capita output y, as in e.g. Bardhan (1971). Because output is a function of per cap;ita capital we take $a(\cdot)$ to be a function of the economy wide per capita capital stock. In addition, we assume $a(\cdot)$ to be concave in K/L, while F is assumed to be strictly concave in K.[7] Dividing equation (1) by LO and writing $y = Y/L$, $k = K/L$, and $f = F(k, a)$ we obtain a formulation in per capita variables:

$$y = f(k, a). \tag{2}$$

The effect $a(K/L)$ is external at the firm level. Given the (normalized) product and factor prices, the linear homogeneity of the production process in K and aL, and perfect competition, the first order conditions for profit maximization are equations (3) and (4):

$$r_t = f_k(k_t, a_t) \tag{3}$$

$$w_t = f(k_t, a_t) - k_t f_k(k_t, a_t). \tag{4}$$

Here f_k is the partial derivative with respect to k, i.e. it denotes the private marginal product of capital, r is the return to capital (savings), w is the wage per unit of "raw" labour (that is, the total wage bill is divided by L), and t is the time index. The private and social marginal product of capital differ, i.e. the private falls short of the social due to the externality $a(\cdot)$. If the rate of capital depreciation is zero,[8] r represents the net return to capital. Note that

$$\frac{dr}{dk} = f_{kk} + f_{ka}a_k. \tag{5}$$

The negativity of (5) can be obtained with a slight extension of the concavity requirement discussed in footnote 7. It ensures that not both capitalists and

[7] Concavity of F with regard to K means that the positive effect on the social marginal product of capital that is due to the externality, $a(K/L)$, is dominated by the diminishing (private) marginal productivity of K. See also Romer (1986) for an alternative assumption.

[8] The choice of a positive rate of depreciation does not matter for our results.

labourers benefit from a higher k. Henceforth we assume

$$\frac{dr}{dk} < 0. \tag{5'}$$

Given this condition, it immediately follows that dw/dk is positive.

Equilibrium in the credit market requires that the demand for investment is equal to the supply. Recalling that the young do not consume, we have that savings per unit of raw labour is equal to income per unit of raw labour, that is, $s_t = w_t$. This implies the following equation for the evolution of capital

$$k_{t+1} = \varphi(k_t) = f(k_t, a(k_t)) - k_t f_k(k_t, a(k_t)). \tag{6}$$

Note that

$$\frac{d\varphi}{dk} = f_a f_k - k f_{kk} - k f_{ka} a_k \tag{7}$$

is positive by (5'). Moreover, the following modified Inada conditions are satisfied

$$\lim_{k \downarrow 0} (\varphi_k(k)) > 1, \qquad \lim_{k \to \infty} \frac{\varphi_k(k)}{k} < 1. \tag{8}$$

These conditions ensure the existence of at least one nontrivial steady state. The model developed thus far puts no sign restrictions on the second derivative $d^2\phi/dk^2$, and hence the model allows for multiple steady states,[9] i.e. ϕ may intersect the diagonal in the (k_t, k_{t+1})-plane repeatedly. Multiplicity can be caused by the shape of either $a(k)$ or $f(k, a)$. The latter possibility is well known (see e.g., Blanchard and Fischer 1988, Galor and Ryder 1989), but it is hard to see its economic connection to the development process. The former source of multiplicity seems more plausible as the improvement of labour efficiency plays a crucial role in economic growth and may also be subject to different plateaus of development (Lucas 1993). Therefore we focus on the former mechanism in the ensuing analysis.

To justify our specification we must first address the relevance of multiple steady state growth rates, especially in relation to issues of international factor market integration and growth and also demonstrate that the particular form of multiplicity adopted here (threshold externalities) is both theoretically and empirically compelling.

the first point is the least controversial, as there exists a voluminous literature that has argued that the concept of multiple equilibria is essential for understanding persistent differences n economic performance across countries and over time within the same country. For example, the endogenous growth literature has relied

[9] All steady states in this model are dynamically efficient because both the rate of population growth and capital depreciation are zero.

extensively on production externalities to generate multiple steady state growth rates. Similarly, the "hysteresis" literature has invoked multiplicity to account for the persistence of "bad" economic conditions such as the high rate of unemployment in Europe (see Blanchard and Summers 1986); and the strategic complementarities (or "coordination failure") literature, see e.g. Cooper and Haltiwanger (1993), has adopted this specification to explain how an economy can be trapped in a low equilibrium.

The source of multiplicity is typically some type of externality. In our paper, as in Arrow (1962) and Lucas (1988, 1993) the externality is associated with the accumulation of human capital from learning by doing. It could be associated with human capital accumulation via schooling or as in Romer (1986) the source of externalities could be physical capital. All these formulations are technically equivalent. We feel, however, that learning by doing is particularly relevant for factor market integration, as the level of skills and hence labour productivity seems to play an important role in growth take-offs (Lucas 1993). Externalities associated with learning by doing can easily generate multiple threshold equilibria. For instance, an underdevelopment trap arises if learning on the job increases fast with the scale of production (or with capital intensity) but eventually tapers off,[10] or more generally, when small additions to the existing capital stock tend to have a

What is the empirical relevance of the concept of a critical mass (threshold) for growth? Murphy, Shleifer, and Vishny (1989) have argued that the industrialization process, that is, the process of moving from a low capital intensity, low income to a high capital intensity, high income equilibrium can be explained via threshold effects. The driving force in their model is externalities arising from high levels of income. If output goes above a critical value then a "jump" to a higher equilibrium becomes feasible. Diamond's (1982) analysis of trading externalities and thin markets suggests a similar scenario.

the literature on underdevelopment traps or stages of growth has too, viewed growth as a discrete process that is subject to thresholds. Some work in this area has emphasized the lack of sufficient savings to finance an investment—and human capital growth—based take-off. Our model has such a property. As mentioned above, the elasticity of savings (labour income) with regard to the capital stock exceeds one to the right of a capital threshold value but falls short of unity to the left (recall that, due to the externality, labour does not capture all of tis social marginal product). That is, a small increase in income may not be sufficient to create the seeds for sustained expansion.

Finally, one can argue that a development trap may be due to various growth hindering frictions (political, institutional, economic). As long as only a large infusion of foreign capital can help an underdeveloped economy overcome these frictions (by creating a critical mass for growth) our analysis remains applicable. This

[10] To see this point differentiate equation (7) and set all cross partial derivatives as well as the third derivatives equal to zero. If learning by doing is subject to local increasing returns then it is more likely to observe a sign switch for $f_{aa}a_k^2 + f_a a_{kk} - f_{kk}$ (because a_{kk} is initially positive and then becomes negative). Multiple equilibria can result from such sign switches.

analysis offers an economic justification for the repeated claims by Eastern European countries that unless they receive substantial help they run the risk of returning to the previous stagnant equilibrium.

We now turn to the study of the process of integration. Suppose that there are two economies which initially are at two different levels of economic development. We will examine the optimal speed of international factor market liberalization on the path towards the long-term level of income of the integrated economies. Specifically, let the two countries have identical production technologies, that is, both are characterized by the accumulation equation $\phi(k)$ in (6), but, let the two countries be in different stages of development due to differences in initial conditions and the absence of international factor movements. Without loss of generality we postulate the existence of two stable steady states, $\bar{k}_1$ and $\bar{k}_2$ with $\bar{k}_1 < \bar{k}_2$. The first steady state, $\bar{k}_1$, is characterized by low income, low learning externalities and the second, $\bar{k}_2$ is characterized by high income, high learning, i.e. $y_1 < y_2$ and $a_1 < a_2$. Each country is assigned to one of these two equilibria.

Define $k = k^*$ as the threshold level of the capital intensity that separates the low from the high state of development. In other words, the dynamics of the capital accumulation are such that investment is monotonically increasing (decreasing) to the right (to the left) of k^* (Figure 1 below depicts a discrete example). This implies that a sustained increase in output in the low income-growth country can occur, i.e. the "underdevelopment trap" can be broken, only when the capital intensity of the economy has been raised enough to support a significant increase in labour efficiency and income. It can be seen that the elasticity of labour income with regard to an increase in the capital stock is less than unity at $\bar{k}_1$ but exceeds 1 at k^*.

Consider now the effects of an international factor market liberalization. We abstract from examining the normative aspects and political considerations regarding the distribution of the short run gains and losses among the various generations, and focus on the positive question whether the low state economy can reach the high state through the liberalization process. Central to the analysis is whether or not the surplus of capital in country 2 is sufficient to sustain a precipitous liberalization with the desired long run effects. Let k_{wt} be the average world capital intensity at time t. Initially, in the autarkic state, the world capital intensity is given by $\bar{k}_w$ with

$$k_{wt} = \bar{k}_w = \frac{K_1 + K_2}{L_1 + L_2} = \frac{\bar{k}_1 + m\bar{k}_2}{1 + m} \tag{9}$$

where $m = L_2/L_1$ is the relative population size of country 2. We have the following result with regard to precipitous liberalization.

PROPOSITION 1. *If $\bar{k}_w > k^*$, then a precipitous international factor market integration results in a permanent increase in the average world per capita income. If $\bar{k}_w < k^*$, then the precipitously integrated world economy experiences a permanent decrease in its income.*

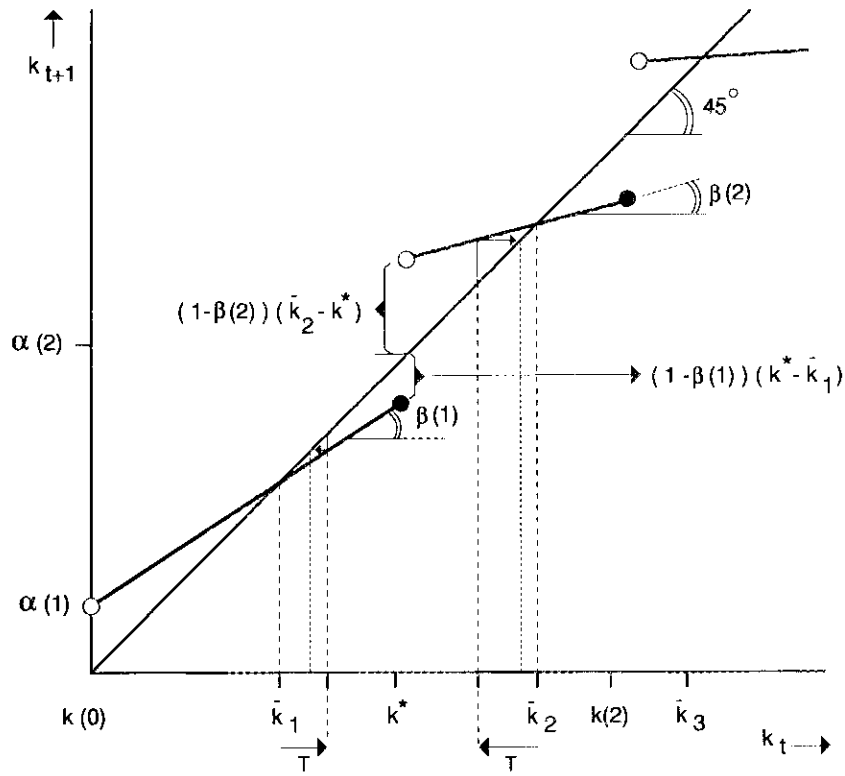

FIGURE 1

THE PIECEWISE LINEAR SAVINGS FUNCTION

PROOF. As the return to capital is greater in the low capital intensity country by assumption (5′), and as the wage rate is lower, this country experiences a capital inflow and/or a labour outflow, until wage and rental rates are equalized. Because international factor markets are completely liberalized at once, the capital intensity of the integrated world economy remains at $\bar{k}_w$. Given the dynamics of capital accumulation, both countries converge to the high steady state if $\bar{k}_w > k^*$ and to the low steady state if $\bar{k}_w < k^*$. □

We will say that a liberalization procedure is an *admissible* policy if the two economies eventually approach the high steady state. Suppose now that $\bar{k}_w < k^*$, so that a precipitous liberalization is not admissible, and consider a piecemeal liberalization that involves a periodic export of capital from the high to the low growth country.[11] We want to know the conditions under which such a gradual scheme is an admissible policy for breaking the underdevelopment trap.

[11] Alternatively, we can employ a plan involving only labour migration from the low income country; or a combination of the two. All these approaches are equivalent.

To facilitate the presentation of the piecemeal liberalization and to enhance the reader's intuition, we will employ a linearized approximation to the nonlinear difference equation (6). As before, the steady state equilibria have a stages of growth flavour in the sense that sustained increases in the effectiveness of labour $a(k)$ occur discretely but now the dynamics of the system are described by linear difference equations. A country remains in a particular stage of development until there is a significant change in its economic conditions that boosts labour productivity significantly. When such a change occurs, the economy jumps to a path that leads to a higher stage of development (see Rosenstein-Rodan 1943, and Rostow 1960). Technically, big push theories imply the existence of bifurcation points in equation (6). Let $k(j), k(j-1) < k(j)$, $j = 1, \ldots, q$, and $k(0) = 0$, be the q bifurcations which demarcate the different stages of development. Thus equation (6) is approximated by the following left continuous stepwise linear accumulation equation

$$k_{t+1} = \alpha(j) + \beta(j)k_t, \tag{10}$$

$$\text{for } k(j-1) < k_t \leq k(j),\ \alpha(j) > 0,\ 1 > \beta(j) > 0.$$

For simplicity, the bifurcations $k(j)$ are taken to occur at the unstable steady states k^* of the nonlinear equation $\phi(k)$, and hence the restriction $1 > \beta(j)$, but this is not necessary. From equation (10) the stable steady states can be easily calculated as $\bar{k}_j = \alpha(j)/(1-\beta(j))$. Note that the steady states are ranked in terms of capital intensity and per capita income as $\bar{k}_{j-1} < \bar{k}_j$. We will continue to work with a specification that has two stable steady-state equilibria ($q = 2$) with $\beta(1) > \beta(2)$ as depicted in Figure 1 (the figure is drawn with $m = 1$). We can now inquire into whether a gradual policy is admissible when a precipitous policy is not.

PROPOSITION 2. *Suppose that $\bar{k}_w < k^*$, so that precipitous integration is not admissible, but that*[12]

$$\beta(1) > \beta(2),\ m(1-\beta(2))(\bar{k}_2 - k^*) > (1-\beta(1))(k^* - \bar{k}_1). \tag{11}$$

Starting in period $t = 0$, consider a series of n equal capital reallocations of size $L_1 T$ towards the low income country. Then any piecemeal program with T such that:

$$(1-\beta(1))(k^* - \bar{k}_1) > T > \frac{(1+m)(1-\beta(1))(1-\beta(2))}{\beta(1)-\beta(2)}(k^* - \bar{k}_w) \tag{12}$$

is admissible.

[12] If supposition (11) is violated, then neither the precipitous, nor the piecemeal program with positive transfers may be admissible.

PROOF. By equation (10), to the left of k^*, capital in country 1 accumulates according to

$$k_{1,t+1} = \beta(1)k_{1t} + (1 - \beta(1))\bar{k}_1 \tag{13}$$

and to the right of k^*, in country 2, according to

$$k_{2,t+1} = \beta(2)k_{2t} + (1 - \beta(2))\bar{k}_2. \tag{14}$$

With a capital flow of L_1T from country 2 to 1, L_1T in per capita format has to be subtracted from equation (14) and added to (13). After a sequence of n repeated flows, the capital intensities in the two countries are

$$k_{1n} = -\frac{T}{1-\beta(1)}[\beta(1)]^n + \bar{k}_1 + \frac{T}{1-\beta(1)} \tag{15}$$

$$k_{2n} = \frac{\frac{T}{m}}{1-\beta(2)}[\beta(2)]^n + \bar{k}_2 - \frac{\frac{T}{m}}{1-\beta(2)}. \tag{16}$$

Recall that according to Proposition 1, a full liberalization in period $n+1$ is admissible if $k_{wn} = (k_{1n} + mk_{2n})/(1+m) > k^*$. Substituting for k_{1n} and k_{2n} from (15) and (16), and using the definition (9) of $\bar{k}_w$ gives

$$k_{wn} = \bar{k}_w + \frac{\beta(1) - \beta(2) + (1-\beta(1))[\beta(2)]^n - (1-\beta(2))[\beta(1)]^n}{(1+m)(1-\beta(1))(1-\beta(2))}T > k^*. \tag{17}$$

Taking the limit of k_{wn} in (17) as n goes to infinity and rearranging yields the lower bound for T in condition (12). During the program, that is, for $t \leq n$, $k_{1t}(k_{2t})$ has to be to the left (right) of k^*. This will certainly be the case if the upper bound in (12) is satisfied, as may be seen from letting n go to infinity in (15) and (16), and by invoking condition (11). Note that (11) guarantees that the set of admissible policies is nonempty. □

From conditions (11) and (12) we see that the crucial factors in determining the admissibility of the piecemeal program are the slopes of the savings function $\beta(1)$ and $\beta(2)$, and the shortage of capital $k^* - \bar{k}_w$. Country 1 saves more from the transfer the higher is $\beta(1)$, and country 2 replenishes the transfer more rapidly the higher is $1 - \beta(2)$, i.e. the lower is $\beta(2)$. Conducive to this are a high output growth rate of the transferor and the responsiveness of labour productivity to capital in the recipient country. Note that $\beta(1) - \beta(2)$ signifies the difference in the change in marginal productivity of labour with respect to a change in capital. The larger this difference, the more effective the transfer of capital, and the more likely the piecemeal program will be admissible. Conversely, if $\beta(1) < \beta(2)$ we are in a situation where the piecemeal liberalization *fails* to improve the world capital stock, but the precipitous may succeed. Suppose that the threshold k^* is relatively close to

the low income steady state $\bar{k}_1$. In this case a precipitous liberalization is feasible if country 2 can afford a large enough capital transfer to support the big leap of country 1. Hence, in deciding the type of liberalization program both the preconditions for growth, i.e. the locations of $\bar{k}_i$ and k^*, as well as the behavioural parameters like the savings ratios β should be taken into account.

Apart from the question of admissibility of a program, it is of interest to enquire how changes in the various parameters affect the speed of a liberalization program. The *speed* of a program is identified by the inverse of the minimum number of steps, $1/n$, needed to obtain $k_{wn} > k^*$. The following results are the basis for the discussion in Section 2.

PROPOSITION 3. *The speed* $1/n$ *of a piecemeal program is an* increasing *function of*: (*i*) *the size of the transfer* T; (*ii*) *the relative size of the populations* $m = L_2/L_1$; (*iii*) *the slope of the savings function* $\beta(1)$ *in country* 1; (*iv*) *the excess of capital in country* 2, $\bar{k}_2 - k^*$; *and it is a* decreasing *function of* (*v*) *the slope of the savings function* $\beta(2)$ *in country* 2; *and* (*vi*) *the shortage of capital in country* 1, $k^* - \bar{k}_1$.

PROOF. Part (i) for $n \geq 2$ follows from manipulating the inequality $(1 - \beta(1))(1 - \beta(2))[\beta(2)]^n < (1 - \beta(1))(1 - \beta(2))[\beta(1)]^n$ to $(1 - \beta(1))[\beta(2)]^n - (1 - \beta(2))[\beta(1)]^n < (1 - \beta(1))[\beta(2)]^{n+1} - (1 - \beta(2))[\beta(1)]^{n+1}$, which shows that the multiplicative factor in front of T in (17) is increasing in n. To obtain (ii), note that $dk_{wn}/dm = \{\bar{k}_2 - k_{wn}\}/(1 + m) > 0$. From $dk_{wn}/d\beta(1) = \{1 - n(1 - \beta(1))[\beta(1)]^{n-1} - \beta(1)^n\} \circ \{T/(1 + m)(1 - \beta(1))^2\}$, and the fact that $n(1 - \beta)\beta^{n-1} + \beta^n < 1$ for $n \geq 2$, we get claim (iii). Note that $dk_{wn}/d\bar{k}_2 = d\bar{k}_w/d\bar{k}_2 = m/(1 + m)$ implies (iv). The proofs for parts (v) and (vi) are similar to those of (iii) and (iv). □

3. DISCUSSION AND CONCLUSIONS

From the propositions above it follows that the admissibility of a plan to integrate low income-low learning with high income-high learning economies depends critically on savings behaviour, population sizes, and differences in the stage of development. These factors also determine the size and the time profile of the resources that are to be transferred. How these factors and the propositions bear upon actual integration practices is discussed below.

Of critical importance for the admissibility of a program is the proximity of the capital labour ratio in the low income country to the threshold k^* (see Propositions 1 and 3). Location captures the "preconditions" for growth and reflects both intangibles such as work ethics, political and financial stability, which cannot by themselves lead to *sustained* increases in labour productivity but can magnify the impact of a given capital inflow; and tangibles such as the capital stock. Consider for example the case of East Germany. It has a large number of well trained engineers whose productivity is low because of the obsoleteness of the existing capital stock. With high tech investment from West Germany a big leap is more feasible there, than in a country at a comparable level of development but with a smaller human

capital base. The German unification is a good example of a liberalization of the precipitous kind, see Proposition 1 and the discussion following Proposition 2. Initially concerns were voiced in West Germany with regard to the speed of integration and in particular regarding its effects on economic growth in the West. It is, however, unlikely that those adverse effects will be long lived because of the factors identified in Proposition 3: namely, (a) the large size of the West relative to the East; (b) the favourable location of the bifurcation point, i.e. the preconditions for growth; (c) the high savings rate in the West; and (d) the high level of human capital in the former East Germany.

Once precipitous integration has been ruled out because of Proposition 1, one must determine (a) whether gradual liberalization is admissible at all and (b) if so, how fast it can proceed. The critical factors determining admissibility are the behaviour of savings in the integrating economies and the shortage of capital, see Propositions 2 and). The EC migration policies of the eighties seem to represent a good application of our piecemeal analysis. The entrance of low wage southern European countries triggered concerns about the northern countries being flooded with labourers, see e.g. Straubhaar (1984), Werner (1986) and Molle and Van Mourik (1988). This concern led to the adoption of the seven year transition period. According to the theory presented here, the seven year transition period may have been imposed on the newest members by the northern countries to avoid a *permanent* decrease in productivity and income that might have resulted with large migration flows from the "undeveloped" South. Hence, it may have reflected a defense of long run *national* welfare levels. Conventional models can only explain this resistance by invoking the standard special interest groups considerations. But it cannot explain why the resistance takes the form of a transition period.

Interesting applications of Proposition 3 are the EC admission procedures and the evaluation of multiple speed programs. Suppose that the current members of the EC are in a high steady state and that there exist several applicants for integration that are in different lower income steady states, each facing a different slope β as well as a different k^*. Furthermore, suppose that there are not sufficient "spare" resources to move all recipient countries precipitously to the high state. How can the *overall* speed of the integration process be maximized? If the available limited resources are uniformly distributed across all applicants then it is possible that integration may either take a large number of steps n, that is, a low speed $1/n$, or, worse, may not even be an admissible procedure at all. To accelerate the overall integration speed it may be optimal to give high doses to a selected subset of the applicants, and then utilize the increased resources to help the remainig applicants. Such a subset of countries ought to be selected on the basis of the two economic considerations: (a) favourable preconditions for growth (Proposition 3(vi)); and (b) the prospects for high labour productivity growth as a result of foreign investment (Proposition 3(iii)).[13] In practice there are two ways of achieving a grobally speeder

[13] the following constitutes a three country, three steady state, two bifurcation points example. Let $(\alpha(i), \beta(i))$ be respectively $(1, 1/2)$, $(2, 1/3)$ and $(3, 1/9)$ for $i = 1, 2, 3$. The two bifurcations are $k(1) = 20/7$ and $k(2) = 16/5$. It can be checked that the only admissible liberalization plan is that which first has countries 2 and 3 integrate in piecemeal fashion, and then let country 1 join the union gradually.

integration. Admission can either be phased out over a period of time so that resources can be concentrated on the few new members, or accompanied by a multiple speed program. The former strategy may be easier to implement because it does not discriminate among new members but among applicants only, and therefore it avoids internal EC conflicts in the allocation of the integration funds. Subsequently, popular integration practices such as two speed transition periods and phasing out admissions may not only make integration feasible, but they can also result in a *globally faster pattern of integration* for all countries involved. Some extensions and further discussion of the integration issue based on this framework can be found in Basevi (1991).

Finally, we discussed in the introduction how this model can be used to determine the amount of capital needed to integrate Eastern Europe with the European Community. A CEPR report estimates that a minimum capital investment of $1,350 billion is required in order to double the current level of per capita income in Eastern Europe. Our analysis suggests that the required contribution of foreign capital may only be a fraction of this amount. Now consider Figure 1 again, with Eastern Europe occupying the low income and the OECD the high income equilibrium. Furthermore, assume for simplicity that, the labour force is of the same size in both groups and that a precipitous integration is admissible (a similar logic applies to calculations involving gradual integration). According to steady state analysis done along the lines of the CEPR report, a capital flow of $\bar{k}_2 - \bar{k}_1$ is needed to bring Eastern Europe income at par with per capita income in the OECD. The results from Section 2, however, suggest that the required flow of foreign investment is only $k^* - \bar{k}_1$. These figures are only indicative and ought not to be taken at face value because they represent back of the envelope calculations. Nevertheless, they show that for precipitous changes, ignoring the transitional out of steady-state dynamics can lead to very pessimistic evaluations of the required total foreign capital flows. For instance, it may exaggerate them by more than 100 percent as $k^* - \bar{k}_1 < (\bar{k}_2 - \bar{k}_1)/2$. Similarly, for the piecemeal approach, out of steady-state behaviour can generate significant increases in world savings (Proposition 2), which considerably reduces the needs for bridging the steady state gap $\bar{k}_2 - \bar{k}_1$.

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