Globalization, Trade Adjustment and Gradualism: An Exploratory Note in a Ricardian model with Overlapping Generations

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Abstract

A general equilibrium model is set up for the entire trading world with overlapping generations, where the initial sector-specific age distribution of labor makes the impact of trade liberalization beneficial for some and detrimental to others, while allocation efficiency is improved. Under the Paretian Principle that trade reform should do no harm after compensation, analysis is done to both formulate and characterize the 'adjustment at optimal speed' proposal of Bhagwati.

1. Introduction

This paper studies how three forces interact in today's world: the accelerated globalization which reduces the barriers to trade; path dependence which binds growth to history; and the call for gradualism out of some notion of 'optimal speed'. The focus is on some novel or less examined themes from the perspective of general equilibrium, rather than an open, small country. Note that the point of reference in Samuelson (2004) and Bhagwati et al (2004) is the status quo, ex ante, not comparing trade against autarky. The defense of globalization by Bhagwati (2004) advocates a due deliberate pace from a universal viewpoint, not as a matter for national advantage like in Davidson and Matusz (2003), or due to the negotiation process like in Bond and Park (2002). Presently, the global adjustment involves countries like America, Japan, China and India, among others, so that the gradualism proposal of Bhagwati is best examined in an all-inclusive general equilibrium and not a one country (or small country) contexts already analyzed by such conributions like Matsuyama (1992). In this paper, the introduction of an overlapping generation structure to the sectoral work force is not to explain decentralized capital formation as in Galor (1992), etc. but to reflect both the reduced adaptation of aged workers and that national advantage shifts when new recruits replace the retired. Therefore, it is essential to account for the overlapping generations of inputs and make sure that current arrangement does not undermine future efficiency. The trade adjustment is for some known and major event, like trade expansion of China after its entry into WTO, not some unexpected shocks.

Policy makers often employ simulation to solve complex problems. Yet to set up useful models for simulation, one needs insight from analytic studies. This justifies the explorative exercise in the current study.

To crystallize issues in the subsequent discussion, next section introduces a simple model. The general properties of the model are discussed in Section 3, which raises and examine some major questions about gradualism for managed trade liberalization. Sections 4 and 5 then provide respectively the main findings about the Ex Ante and Free Trade Equilibria. Section 6 focused on the initiation of a Managed Trade Program. Section and its continued implementation. The final section offers concluding remarks.

2. A simple model - The setting

To clarify complex issues, a tractable model is set up from some simplest possible assumptions.

A1. (The Economic Environment).

In a world with two *symmetric* hemispheres, ('home' and 'foreign'), there is only intra-hemisphere trade in the ex ante state. Globalization opens the world to 'inter-hemisphere' trade of goods under competitive market without lending and borrowing.

The symmetry assumption simplifies greatly the subsequent analysis. For example, there must be a world equilibrium terms of trade of one to one, in any Free Trade or Managed Trade Equilibrium. Generalization may be carried out in future work.

A2. (Production technology)

Two perishable goods, x and y are produced under constant returns with labor as the only input for production. In symmetry, each hemisphere has absolute advantage in labor productivity of 1 to θ, $0 < \theta < 1$ in one particular good.

Without losing generality, it is assumed that the Home (Foreign)Hemisphere enjoys productivity advantage in x;(in y, the numeraire).

A3. (Ex Ante labor allocations)

Each hemisphere has two identical countries. Initially, each country is completely specialized. One country (the 'Country Right') specializes in the good where that hemisphere has the comparative advantage[1] and the other country (the 'Country Wrong') in the other good.

Were there any degree of Marshallian scale economy, complete specialization is the natural outcome. In this study under constant returns, the assumption is chosen to dramatize the implications of differing initial labor allocations over the sectors. This shows that the economic evolution is 'path dependent'.

A4. (Preference)

The common felicity index for all persons is loglinear, with equal spending weights on the two goods.

A5. (Age structure)

In each country, labor consists of a continuum of equal-sized cohorts: each cohort has a unit measure; each worker is endowed with a working life of unit length.

A6. (Effect of on-the-job habit formation)

Relative to the productivity of a new worker, the productivity of an old worker transferred to a new industry at age a ($0 \leq a \leq 1$) is a fraction f(a). f(a) is non-increasing in a: $f(0) = 1$.

This assumption is chosen for its tractability, not realism. In general, older workers may play roles different from the new workers in many ways. Productivity may improve for workers staying in the same industry, due to learning, or the presence of old workers may share experience or provide supervision to improve the productivity of workers in younger cohorts. Such advantages are lost when old workers are transferred to a new industry. Much additional research is needed to account for these other possibilities.

3. A simple model - Some general properties

In this model, labor force in any country has the overlapping generations structure, as shown in Figure 1, where time is specified in discrete periods for easy depiction, Age matters only if a worker changes industry, implying that habit formed in another industry hinders productivity. Compared against the productivity of a new worker, the productivity of a transferred worker who worked elsewhere for an interval a is only a fraction f(a), as shown in Figure 2 below.

An economy realizes its maximum productivity, if no worker of any cohort has ever changed industry. The set of output vectors producible on that basis forms the 'long run' production set. See ( ). In contrast to the traditional literature, it is not possible to shift instantly from one point on the 'long run' production possibility frontier to another point on the same frontier.

Figure 3 depicts the 'long run' production set of either country in the Home Hemisphere, with the two output vector, (x, y) = (1, 0), and (0, q) representing the maximum output under complete specialization. The 'long run' production frontier lies between these two.

[1] compared against the other hemisphere.

Figure 1 The Overlapping Generations

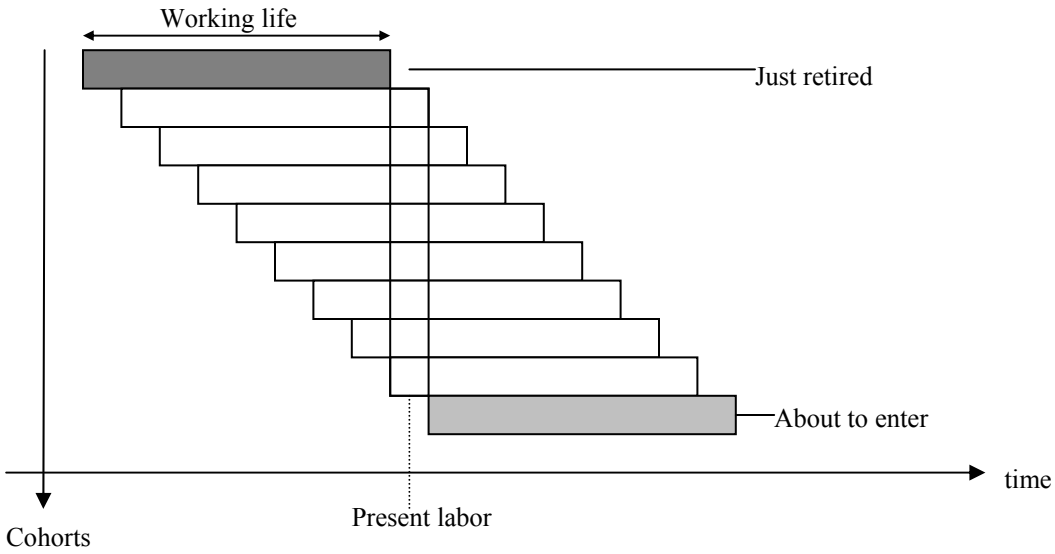


Figure 2 Productivity of a transferred worker

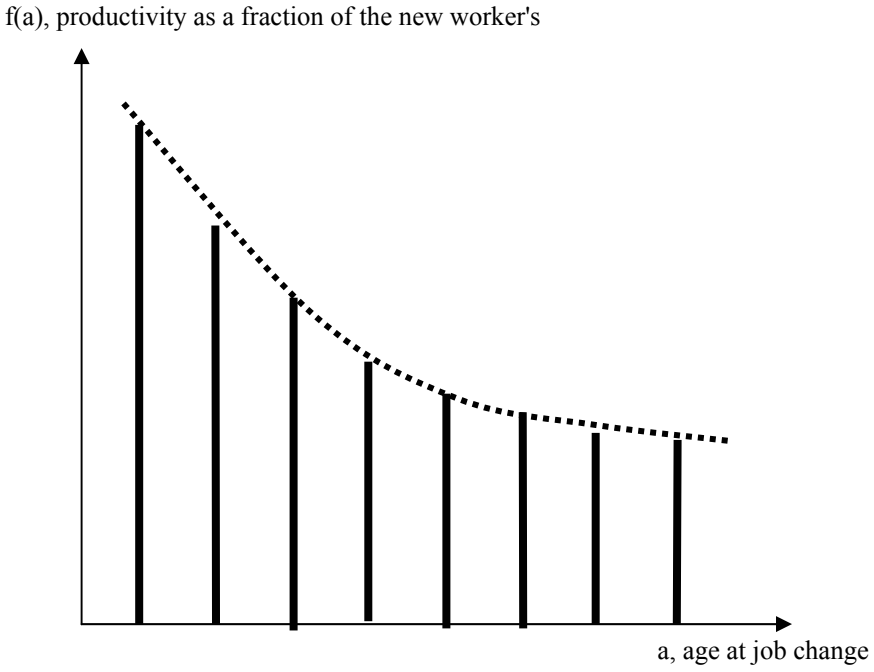
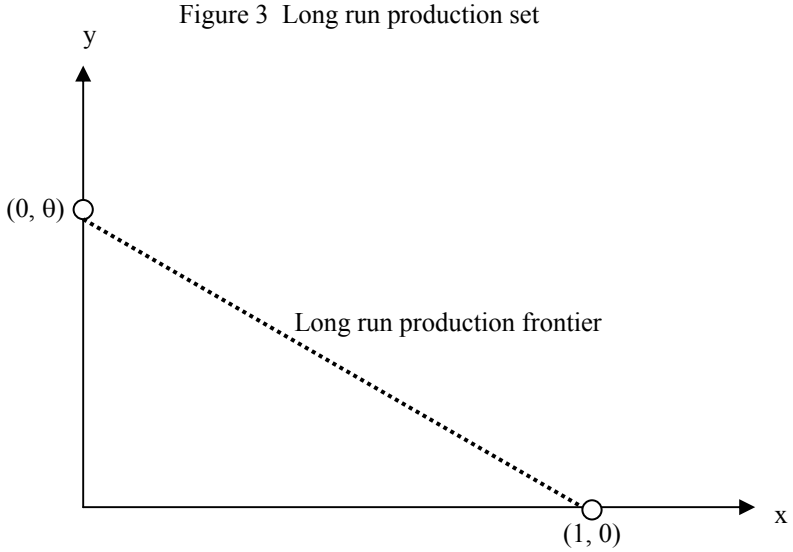


Figure 3 Long run production set

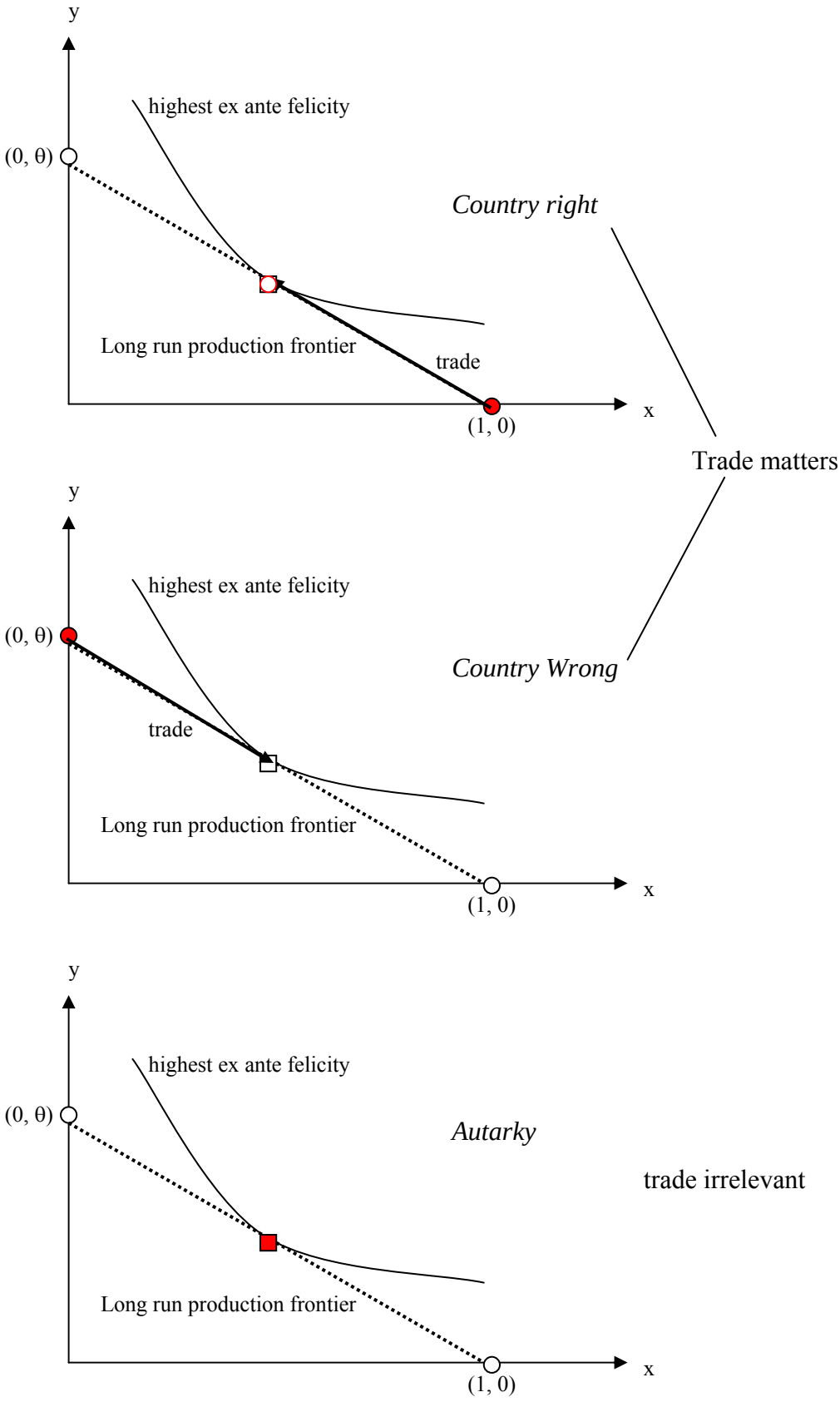


Several remarks may be made about the above model.

First, this model showcases the importance of 'path dependence'. Without any reference to possible differences in the age-industry structure of labor allocations, then, technologically speaking, both countries in any particular hemisphere are in equally advantageous positions.

Second, provided no worker has ever changed industry, in the ex ante state, intra-hemisphere trade makes both countries in any hemisphere equally advantageous, irrespective to any initial labor allocation. If both countries are completely specialized, the gains from trade 'means everything'. Readers can check that in the other extreme, the initial labor allocations can be such that both countries enjoy the same welfare under autarky, and intra-hemisphere becomes superfluous See Figure 4.

Figure 4 Ex ante situations - a pre view
Long run production set, output from initially allocated labor, trade and welfare



Third, considering the assumed initial labor allocations in the Ex Ante equilibrium, trade liberalization would give more benefit to the 'Country Right', than the 'Country Wrong', in fact may be at the expense of the latter.

Fourth, by construction, the 'Country Right' will not change its export, and surely gain from trade liberalization, by the Krueger - Sonnenschein Theorem. The focus of this paper is therefore focused upon what may happen to the 'Country Wrong', where some workers would change industry, others may not.

Sixth, the 'Country Wrong' may or may not be better off. There will surely be individuals who gain from liberalization, but there may also be individuals who will lose from trade liberalization.

Seventh, there may be no way the Country Wrong can use lumpsum compensation to provide a safety net for every individual so that the latter fares no worse than in the status quo, Ex Ante.

Eighth, by the Gains from Trade Theorem of Grandmont and McFadden (1972), if it so chooses, the Country Right can help compensate everyone in the Home Hemisphere (including those in the 'Country Wrong') to fare no worse than in the Ex Ante state. But the political economy in the 'Country Right' may not permit such lumpsum transfers through foreign aid. At the same time, the implementation of trade liberalization may be somehow conditioned upon the well-being of all individuals in the 'Country Wrong', for example, it is subject to the veto of the latter. That is why the Bhagwati Proposal for gradualism deserves consideration, regarding both its feasibility and other implications.

Although the first two points are relatively simple, the others are less obvious, and will be discussed below.

In this study, there are actually four aspects of analysis,

A. The A Priori situation, regarding the technology, before any labor allocation is known

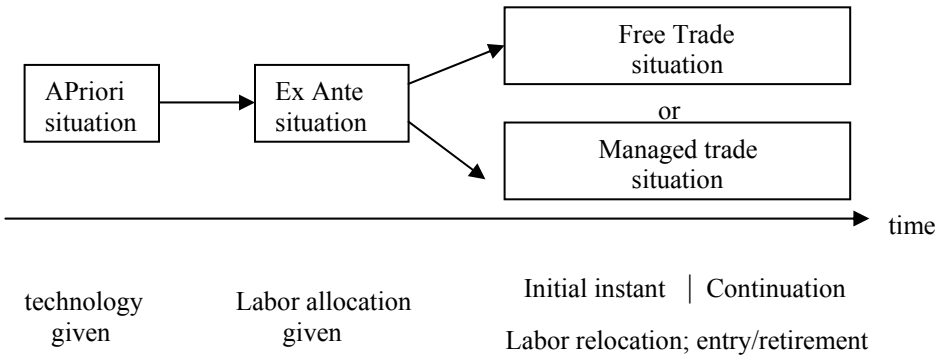
B. The Ex Ante situation, where each hemisphere is an isolated system, and no inter-hemisphere trade

C. The Free Trade situation where inter-hemisphere trade is allowed.

D. The managed trade where a limited inter-hemisphere trade is conducted.

Schematically, Figure 5 indicates how these four are interrelated. It is only when free trade leaves some individuals worse off, and the State cannot finance a safety net for everyone, managed trade becomes considered,

Figure 5 The various situations



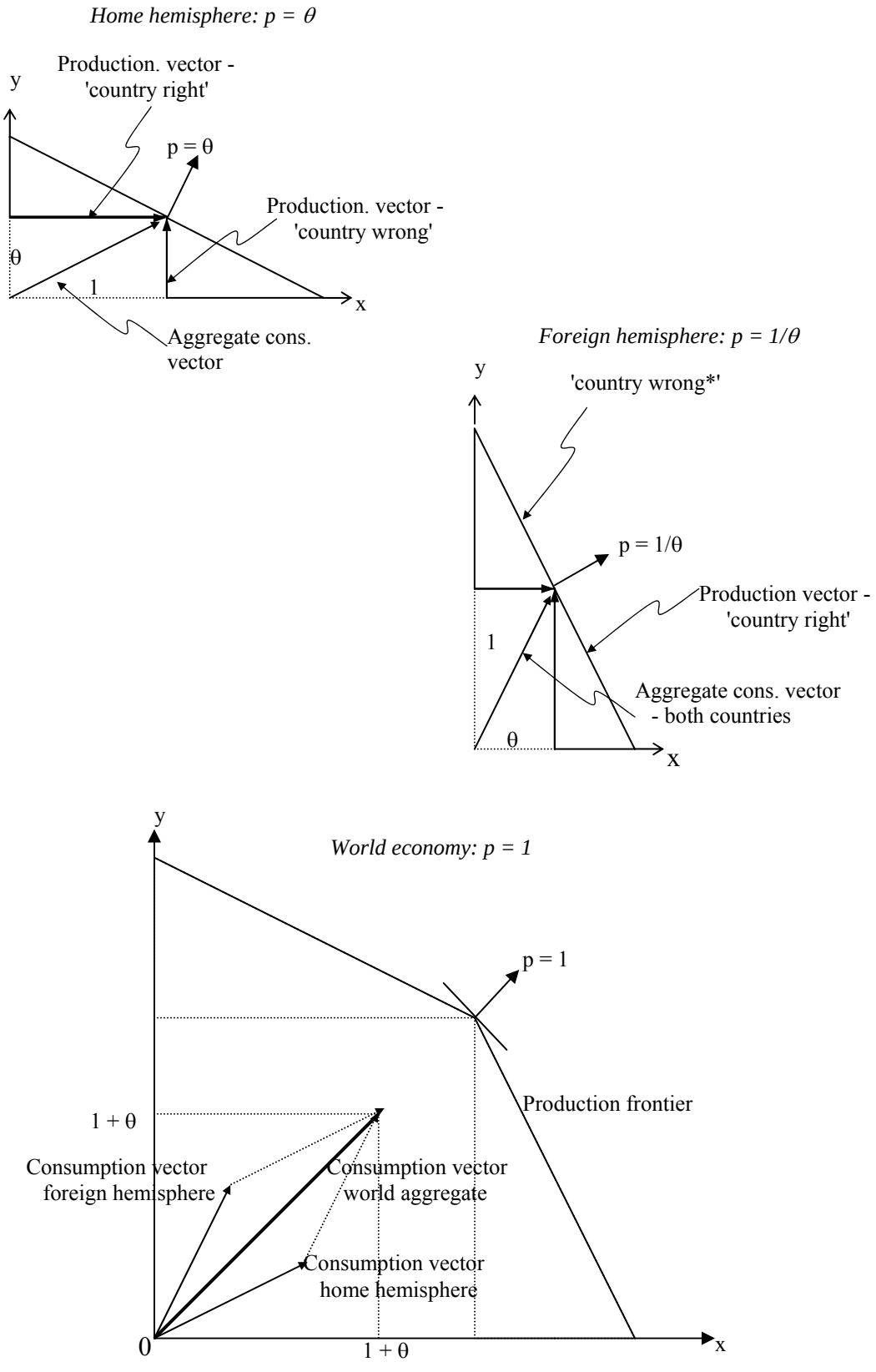
4. The Ex Ante Equilibrium

The Ex Ante equilibrium allows for non inter-hemisphere trade, consequently, one can study how the trading equilibrium functions, hemisphere by hemisphere. In Figure 6, the top panel shows the Home Hemisphere, where the aggregate production set is clearly the linear sum of the two country production set, and the aggregate oroduction vector is the vector sum of the two country-specific production vectors. By market clearance, this hemispere-specific aggregate production vector equals the hemispere-specific aggregate consumption vector, and thehemisphere-specific supporting price $p = \theta$ reflects the ratio of unit costs of the two goods. The middle panel displays the same for the foreign sector.

Finally, construct the world production set . Summing up the two hemishere - specific consumption (or production) vectors, and clearly, that vector is $(1+ \theta, 1+ \theta)$, which is dominated by the feasible world aggregate production vector, (2, 2). Thus, one obtains immediately.

Proposition 4.1. The Ex Ante situation is inefficient.

Figure 6 The Ex Ante situation



5. The Free Trade Situation

By symmetry, one can state straightforwardly,:

Lemma. The equilibrium terms of trade under free trade is: 1.

Also, concentrate on rthe Home Hemisphere, one can state immediately,

Proposition 5.1

For Country Right,

(a) each and every individual continues to produce the same good in the same amount as in the Ex Ante situation.

(b) each person now consumes (1/2. 1/2), and enjoys a felicity level, 1/2, in contrast to (1/2, θ/2) with a felicity level, $(\theta)^{1/2}/2$, under the Ex Ante situation: an improvement due to the terms of trade effect: $1 > \theta$.

Now attention can be focused on the Country Wrong, with three questions:

(a) who would change job?

(b) whether the Ex Ante felicity level can be maintained?

(c) Can the Country assure everyone that Ex Ante felicity level?

Suppose in general, the price is p, $\theta \leq p \leq 1$, then define for cohort a,

$M(p, a, \theta)$ = Max $(pf(a), \theta)$, the equilibrium output value

$E(p, \theta)$ = Min $(px+y)$

subject to: $(xy)^{1/2} \geq (\theta)^{1/2}/2$,

or,

$E(p, \theta) = (p)^{1/2}(\theta)^{1/2}$,

the minimum expenditure to attain the Ex Ante felicity level.

Lemma 5.1

(a) cohort a would change job if:

$M(p, a, \theta) > \theta$,

or equivalently,

$f(a) > \theta/p$,

or, for all $a < a°(p) = f^{-1}(\theta/p)$,

(b) cohort a would fail to maintain the Ex Ante felicity level, if:

$M(p, a, \theta) < E(p, \theta) = (p)^{1/2}(\theta)^{1/2}$,

(c) The Country can assure all cohorts the Ex Ante felicity level, if:

$\int_I M(p, a, \theta)\, da \geq (p)^{1/2}(\theta)^{1/2}$, where I = [0, 1],

or, equivalently, if,

$A(p, 1, \theta) \geq (p)^{1/2}(\theta)^{1/2}$,

where

$A(p, a, \theta) = [\int_{I(a)} M(p, \tau, \theta)\, d\tau\ ]/a$, where I(a) = [0, a].

Remark. The functions A and M have the similar relationship to each other as the average and marginal schedules in economics.

For the free trade situation, p = 1, To visualize the decision of each cohort to change job or not, onemay refer to Figure 7 below. The upper panel reproduces Figure 2, showing that the produc tivity of transferred worker decreases with the increase of a. In the left hand panel, this fact is reflected in the changing shape of the cohort-specific production set. Three specimen of such production sets are displayed in the right panel. In particular, as $f(a°) = \theta$, it is breaking even for workers of cohort a° to transfer to another industry.

Actually, one can use the schedule of f(a) to derive M(.) and A(.) and study the questions (a), (b) and (c). This is displayed in Figures 8, 9.and 10.

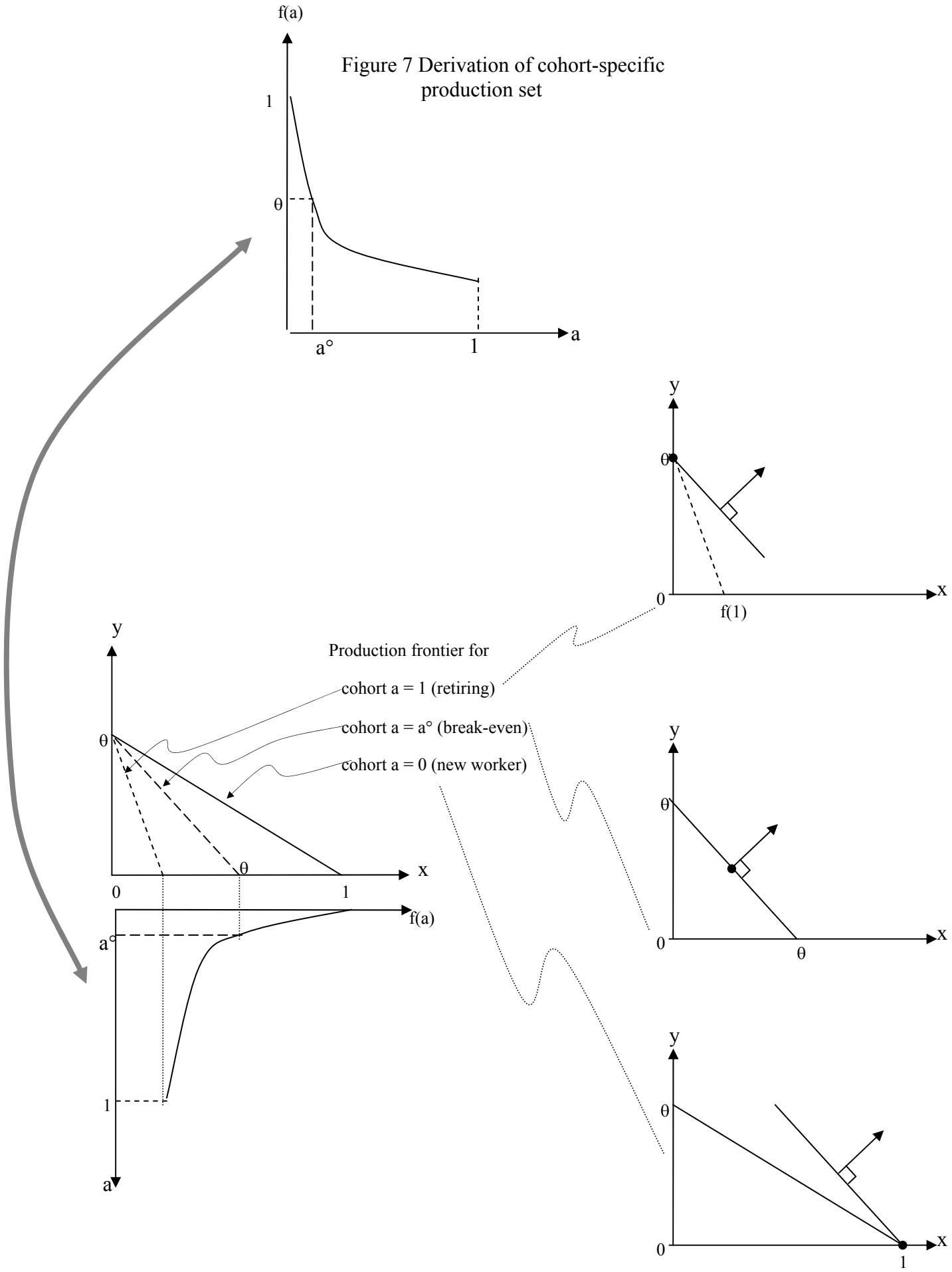
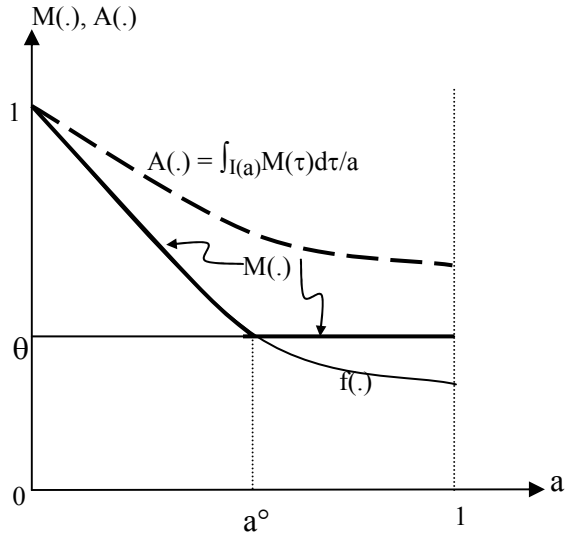


Figure 7 Derivation of cohort-specific production set

Figure 8 below relates the schedules M(.) and A(.) to f(.). Given M(a) defined as the equilibrium income for cohort of age a under free trade, then $A(a) = \int_{I(a)} M(\tau)d\tau/a$ is the average equilibrium income of all cohorts up to age a, and A(1) is the average national income under free trade, which coincides with national income, since the total mass of cohorts, age 0 to1, is unity.

Figure 8 The M(.) ~ A(.) schedules



Next, utilizing Figure 8, one can study the three questions stated before. Given the M(.) and A(.) schedules, the answers to these questions depend on the value of θ, as shown in Table 5.1.

Tablie 5.1 A typology of cases

(a) Everyone changes job?		(b) Anyone worse off?		(c) A safetynet for all affordable?		Cases
Criterion	Ans.	Criterion	Ans.	Criterion	Ans.	
					Yes	I. YNY
			No			
	Yes	$f(1) = \theta^{1/2}$			Yes	II. YYY
			Yes	$A(1) = \theta^{1/2}$		
$f(1) = \theta$					No	III. YYN
	No				Yes	IV. NYY
			Yes	$A(1) = \theta^{1/2}$		
					No	V. NYN

The above table can be further illustrated with the following diagrams in Figures 9 and 10.

Figure 9 A correspondence between Cases and Graphs (1)

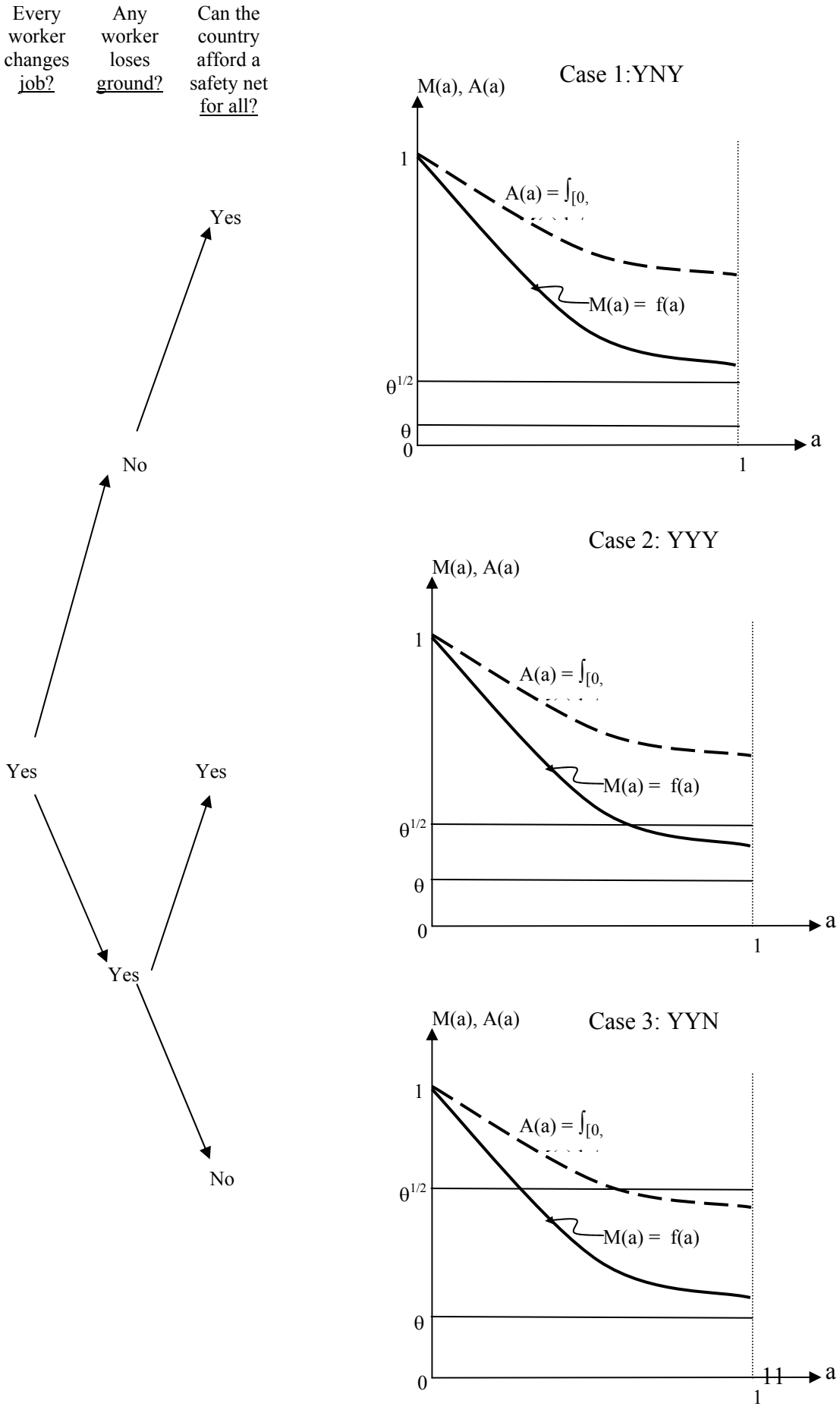
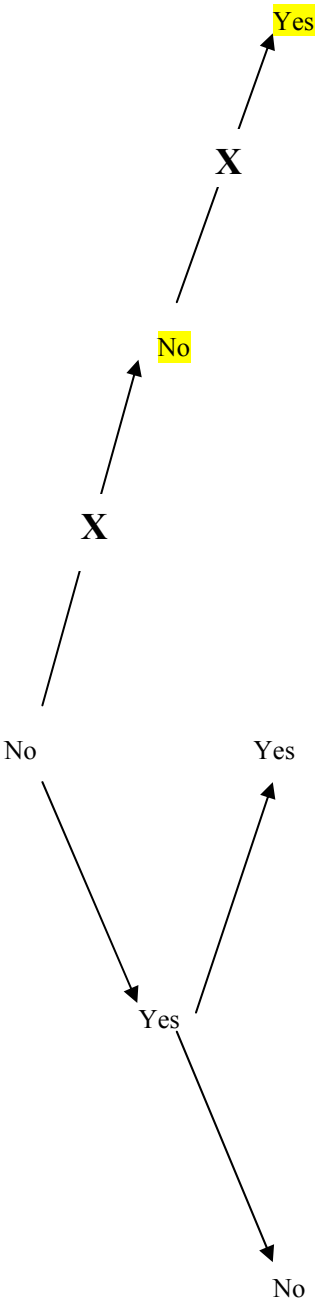
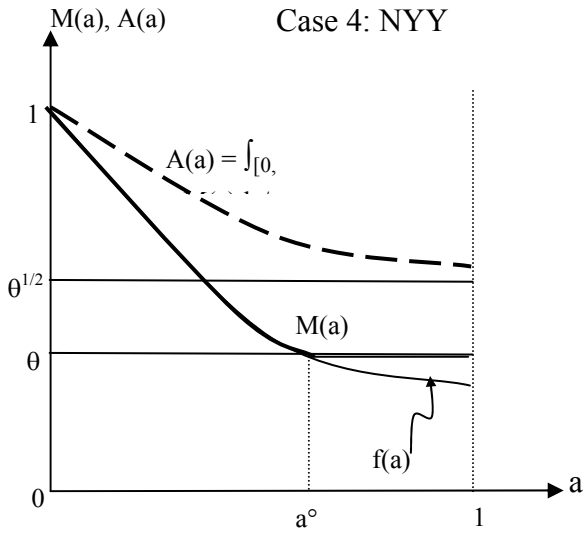
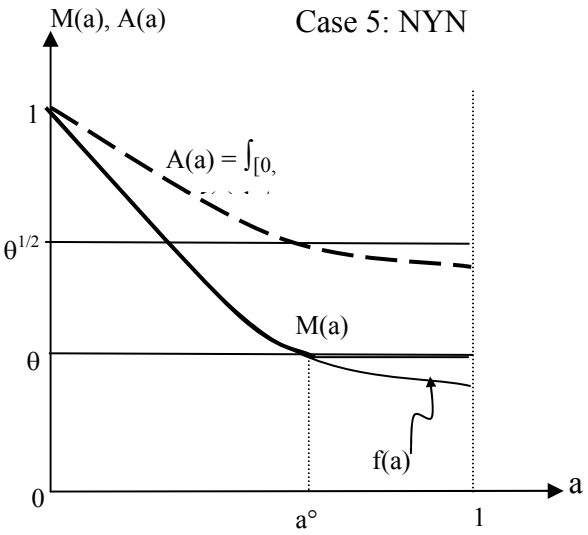


Figure 10 A correspondence between Cases and Graphs (2)

Every worker changes job?	Any worker loses ground?	Is a safety net affordable for all?







Lemma 5.2

$\theta^{1/2} > \theta$.

Proof.

Since $0 < \theta < 1$.

One can deduce,

Proposition 5. 1 (Characterization)

There is always a non-empty collection of cohorts [0, a°) (respectively, [0, a°°]) changing jobs (respectively, doing no worse on their own than under the Ex Ante state), with $0 < a^{\circ\circ} = \min[f^{-1}(\theta^{1/2}), 1] \leq \min[f^{-1}(\theta), 1] = a^{\circ}$.

Corollaries:

5. 1 ('The oldest cohort criterion').

(a) If some cohort does not change job, the oldest must not, that is:

$f(1) < \theta$.

(b) If some cohort fares worse on their own than in the Ex Ante state, so must the oldest, that is:

$f(1) < \theta^{1/2}$.

5.2 (The implication of Krueger-Sonnenschein Theorem)

(a) (Direct version) Any cohort not changing job must do worse than the Ex Ante state on one's own,

(b) (Converse version) Every cohort does no worse than in the Ex Ante state on one's own, then each cohort must have changed job.

Shift attention now to the question of the affordability of a state-sponsored safety net, one has naturally, , by the construction of the A(a) schedule,

Lemma 5.3

A(a) > M(a) for all a, hence A(1) > M(1).

So one can state for completeness the obvious.

Corollary 5.3

If some cohort fares worse off than in the Ex Ante state, the country may or may not be able to afford a safety net for every cohort; if the country cannot afford a safety net, then some cohort (ipso facto, the oldest) must fare worse than in the Ex Ante state.

Based upon Figure 8, one can develop graphically the *comparative static* results for a° and $a^{\circ\circ}$, showing that given f(.), they are negatively associated to changes in the value of θ. Introduce R, the partial ordering of weakly, pointwise dominance over F, the class of all negatively sloped functions, f(.), showing that both a° and $a^{\circ\circ}$ respond positively to a more dominant f(.). These are left with the interested reader.

.Finally, for illustration, consider a family of f - functions, based on the modified CES formula:

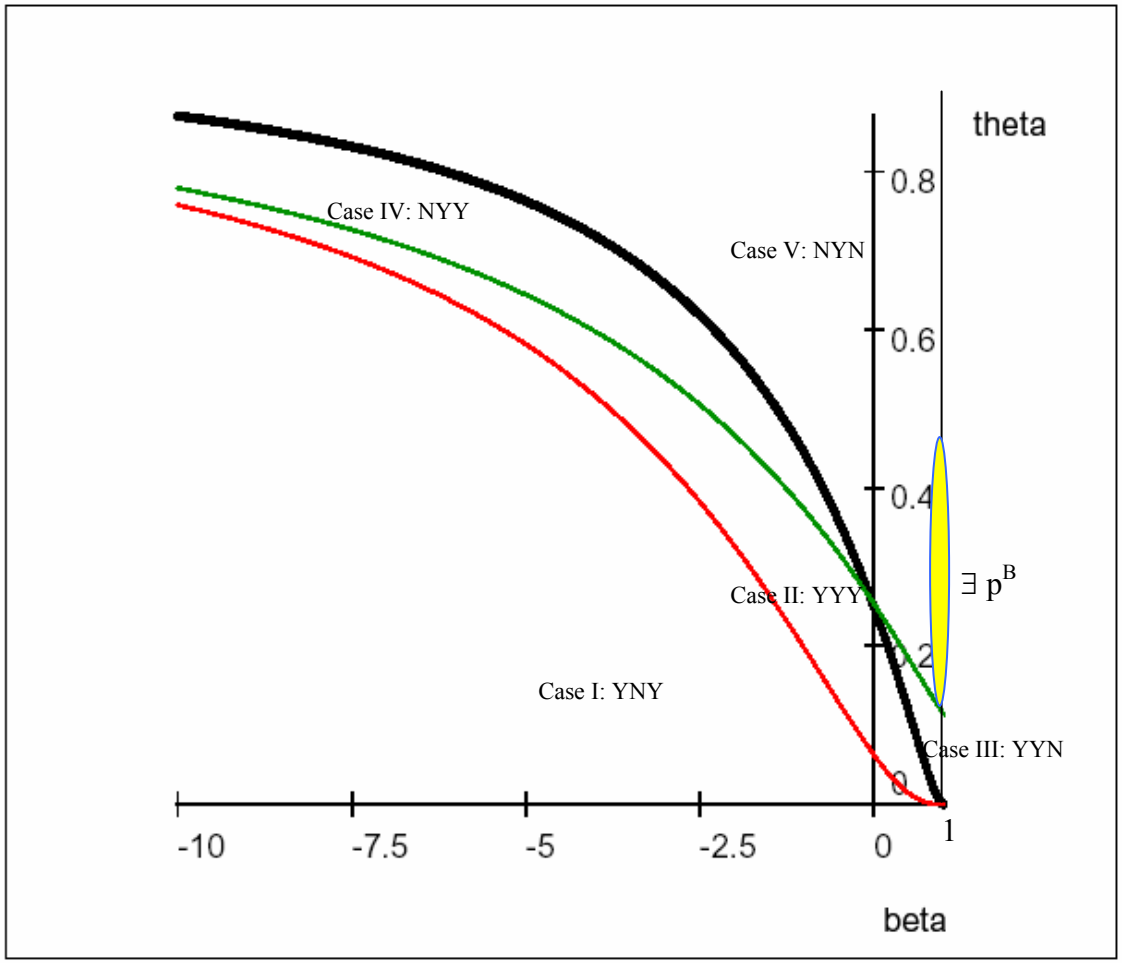
$[(1+a)^{\beta} + f(a)^{\beta/2}]^{1/\beta} = 2$,

one has the result:

$f(a; \beta) = [2 - (1+a)^{\beta}]^{2/\beta}$,

so that one can construct a parameter map for the ordered pair of (β, θ) in Figure 11.

Figure 11 A Parameter Map



6. The Managed Trade

The Initial Moment

Consider a world in either Case III or Case V. Trade liberalization would raise production efficiency. But for institutional reasons, the would-be losers in Conroe Wrong must be placated, yet unlike in the opening to trade from autarky, in this case, the State lacks the resource to do so. Intra-hemisphere assistance holds the key. Should each hemisphere be treated as one country, the Grandmont-McFadden Theorem states that the Country Right has sufficient gain to compensate all losers in Country Wrong with lumpsums. Again for transaction costs or political economy, suppose this is infeasible. What is to be done? That is where the gradualism proposal of Bhagwati (2004) comes in. The suggested cure is to proceed at 'optimal speed'.

This attractive notion raises several questions. First, how does partial liberalization work? Second, why does the detour from full reform leads to steady but modest progress, rather than stagnation? Third, any slowing down of liberalization which might help the Country Wrong comes at the expense of the potential gain of the Country Right, so which pace can be said as optimal? It is to cut the Gordian Knot, that this present model is designed, seeking tractability out of stark simplicity.

Last question first, one attempts to meet any reasonable objection from the Country Wrong at the minimum cost of the Country Right. In short, one would offer the former a safety net for all, guaranteeing the Ex Ante felicity, but with the least deviation from the terms of trade in free trade which favors the Country Right. For the ease of reference, denote this as Bhagwati optimality.

Without losing generality, one may focus on the Home Hemisphere, to see how this works, where the free trade price is 1 and the Ex Ante price is θ, and one might choose p in between. Now restrict inter-hemisphere trade with quantity quota. p, the price of good x, the natural export of the Home Hemisphere which enjoys productivity advantage, would be prevented to reach instantly its free trade goal, easily confirmed by symmetry. Lemma 5.1 (a) then shows the less is p, the more will be θ/p, and hence the less will likely be the extent of job transfer, $a^\circ = f'^{-1}(\theta/p)$, due to the fact that $f' < 0$. Thus, by slowing down trade liberalization, price adjustment and job transfer will be slowed, in consistency with the intuitive view of Bhagwati.

The program is to seek the largest p (closest to 1), p^B, the 'Bhagwati price', if any exists, which allows Country Wrong to finance its own safety net.

Formally, this means:

Find $p^B = \text{Max } \{p \in [\theta, 1]: C(p) = A(p, 1, \theta) / E(p, \theta) \geq 1\}$,

where,

$C(\theta) = 1$; $C(1) < 1$, since the situation is in Case III or Case V.

Remark.

If $p^B = \theta$, then gradualism fails since Ex Ante state is all that is possible.

By experimentation, it is found that,

Proposition 6.1

$p^B \in (\theta, 1)$

some of the time but not all the time.

Proof.

For b = 1, there is a range of θ, where, $0.13 < \theta \leq 0.49$, p^B exists as shown below.

An alternative characterization of p^B is as follows.

Find $p^B = \text{Max } \{p \in [\theta, 1]: D(p; \theta) = A(p, 1, \theta) - E(p, \theta) \geq 0\}$

where for β = 1, D(p; θ) is a function of p, parametrized by θ.

For Case V, only some cohort changes job, the analysis is done in Figure 12, where each concave curve represents the 'excess compensation schedule' , with two properties:

(a) $D(\theta, \theta) = 0 = D(p^B; \theta)$

(b) $D(p; \theta) > 0$, for all $p, \theta < p < p^B$.

Therefore, one may write,

$p^B(\theta)$ such that $D(p^B(\theta^\circ); \theta^\circ) = 0$, for any particular θ°,

where the Bhagwati price, p^B is the largest p, or the price with the least deviation from the free trade price, 1, that the excess compensation D is zero. Since t largest is the deviation from 1, the larger is the 'sacrifice' to the 'Country Right', the price p^B satisfies the well defined concept of Bhagwati optimality.

Two points are now clear:

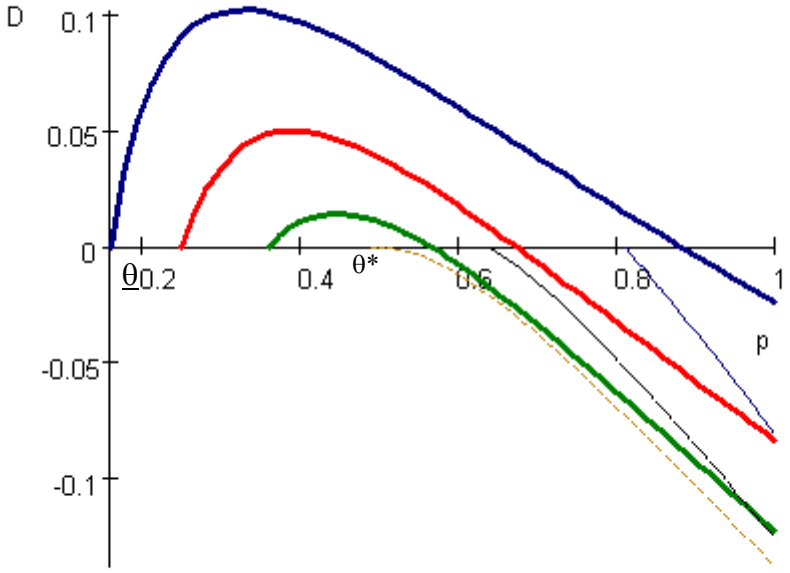
(a) $d\, p^B(\theta)/d\theta < 0$

which means, the less is the 'absolute advantage', or the larger is θ, then the less is the Bhagwati price, or the larger is the sacrifice to the 'Country Right'.

(b) p^B exists up to some $p^B(\theta^*)$ where the curve $D(.,\theta^*)$ is tangent to the p-axis.

By solving a quartic equation, using the Ferari method, one finds the value around .49 for θ*. On the other hand, there is $\underline{\theta}$, about 0.13, the minimum relevant value of θ, where one reaches Case III, every cohort changes job. The range (0.13, 0.49] is marked on the b = 1 line in Figure 11 in an oval.

Figure 12 In search of p^B, the Bhagwati price



Similarly, one cqan show that for β = 0, no p^B can exist.

The Continuation

A program of managed trade is supposed to have the terms of trade converging to its free trade level, therefore a second necessary condition is that the time derivative of p^B is positive. This can be checked as follows.

Since at equilibrium,

$C(p) = A(p, 1, \theta) / E(p, \theta) = 1,$

its logarithmic time derivative must be zero:

$(dA/dt)/A = (dE/dt)/E,$

with,

$A = E,$

or,

$\partial A/\partial t + (\partial A/\partial p)(dp/dt) = (dE/dp)(dp/dt).$

Suppose this is in Case 5, then the passage of time means the new cohort workers would produce value p $f(0) = p(1) = p$ and the retiring cohort will produce $\theta < p$, so that:

$\partial M/\partial t = p - \theta > 0.$

Thus,

$dp/dt = (p - \theta)/[(dE/dp) - (\partial A/\partial p)]$

By some preliminary analysis, one can verify that for the initial p^B within some range, the above expression is positive.

From thee economic viewpoint, the Country Right can always compensate the Country Wrong by inter-country transfers via foreign aid. The use of managed trade presumably means that for reasons of political economy, it is much easier to delay free trade with quota, than collect massive funds by taxation, and transfer it as foreign aid.

8. Concluding Remarks

This is an exploratory study, and much follow up work still need to be done.

Real world negotiations do follow the Pareto Principle at the least in spirit. In such negotiations, no one explicitly calls for arrangements making some participant worse than the status quo, Ex Ante . The delaying of implementing free trade is common. The acceptance of an outright quota system like the Multi-fiber Agreement is also well known. The terms of trade externality caused by a quantitative restriction affects all parties. So issues like the gradualism proposal of Bhagwati must be studied in models of all-inclusive general equilibrium.

What makes the present study different from the literature is that the analysis proceeds with a dynamic general equilibrium, and there is no attempt here to invoke the usual small country assumption. Moreover, at a time that India and China are entering the world market, in *full court press*, it is time to approach trade issues in the framework of general equilibrium.

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