political economy Studies in the Surplus Approach

volume 2, number 1, 1986

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Trade, Growth and the Pattern of Specialisation *

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Introduction

Recent work on the theory of international trade using a Sraffian approach has led to a reconsideration of the determinants of the pattern of specialisation and has produced some new results concerning the issue of the gains from international trade in the context of growing economies[1]. Among these results there is the possibility of losses from trade arising from the non-optimality of the choice of specialisation or from a temporary fall in employment in the trading economy. However, in the absence of a divergence between the rate of profit and the rate of growth (which is the source for the possibility of a non-optimal choice of specialisation) and abstracting from the possibility of temporary falls in employment, the longer term effects of international trade are clearly positive, leading to an outward shift in the wage-profit and consumption-growth frontiers. The effects of specialisation are analogous to technical progress (or, rather, to a once and for all technical improvement)[2].

The main reason for this conclusion is that in these models, as one author puts it:

"Economies are indifferent whether in the equilibrium solution they produce commodities 1 through h or commodities $h+1$ through n. In more pedestrian

* Paper presented at the Conference on "Sraffa's *Production of Commodities by Means of Commodities* after 25 Years", Florence, August, 1985.

[1] See, for example, I. Steedman, *Trade among Growing Economies*, Cambridge, Cambridge University Press, 1979; S. Parrinello, "Distribuzione, sviluppo e commercio Internazionale", *Economia Internazionale*, 1973; S. Levy, *Towards a 'Sraffian' Approach to the Theory of International Trade*, Boston, Boston University, 1980.

[2] One important exception to this result is to be found in L. Pasinetti, *Structural Change and Economic Growth*, Cambridge, Cambridge University Press, 1981, Ch. XI. The similarities between his analysis and our results in section 2 of this paper will become clear in the text.

terms, from the point of view of the model, it does not matter whether in the equilibrium solution you produce bananas or computers"[3].

The purpose of this paper is twofold. First, we shall try to show that the pattern of specialisation can be said to have no important implications on the growth path of the economy only when one adopts the commonly made assumptions of no technical progress (in particular, no differential rates of technical progress), constant returns to scale and uniform income and price elasticities of demand for the different commodities. Secondly, we shall claim that the abandonment of these unrealistic assumptions introduces long-term effects on international trade, which may or may not be positive for the trading economy, depending on the pattern of specialisation and on the resulting growth path of the economy.

1. A SIMPLE MODEL OF A GROWING ECONOMY: THE STATIC GAINS FROM TRADE

Our propositions may be illustrated by means of a very simple model. Let us consider, first, an autarkic economy producing two commodities (1 and 2) by means of labour alone. The rate of profit is, implicitly, zero and the wage rate is uniform across the two industries. Although there is no capital accumulation, the economy grows through time as the employed labour force grows exogenously at a constant rate g. At any time, all wage income is completely consumed in the two commodities. At time t, the economy may be described by the following system of equations:

$$(1) \quad p_1(t) \cdot Q_1(t) = L_1(t) \cdot w(t)$$

$$(2) \quad p_2(t) \cdot Q_2(t) = L_2(t) \cdot w(t)$$

$$(3) \quad p_1(t) \cdot Q_1(t) = \alpha(t) \cdot L(t) \cdot w(t)$$

$$(4) \quad p_2(t) \cdot Q_2(t) = [1 - \alpha(t)] \cdot L(t) \cdot w(t)$$

$$(5) \quad L_1(t) = a_1(t) \cdot Q_1(t)$$

$$(6) \quad L_2(t) = a_2(t) \cdot Q_2(t)$$

$$(7) \quad L(t) = L_1(t) + L_2(t)$$

$$(8) \quad L(t) = L(0) \cdot e^{gt}$$

$$(9) \quad w^*(t) = \frac{p_1(0) \cdot Q_1(t) + p_2(0) \cdot Q_2(t)}{L(t)}$$

[3] S. LEVY, *op. cit.*, pp. 119-20.

where p_1 and p_2 are the prices of commodities 1 and 2, Q_1 and Q_2 the quantities produced and consumed of the two commodities, L_1 and L_2 the levels of employment in the two industries, L is total employment and w the wage rate. $\alpha(t)$ is the fraction of income consumed in commodity 1 and therefore, when relative prices change, a given and constant α implies a unitary price elasticity for both commodities. $w^*(t)$ is the real wage measured at prices of the initial period and, under our assumption, it is also a measure of real income per employee.

We shall compare the growth path of the autarkic economy with that of an economy which starting at time 0 is open to international trade. We shall make the assumption (until the last section) of the small open economy facing given terms of trade and no demand constraints on the quantities exported and also that the level of total employment is the same, at any time, as in the autarkic economy. Thus, when the economy opens to trade in period 0, the industry in which the economy specialises absorbs instantaneously the labour force which was employed in the industry which disappears.

Let $P_2(t)$ be the international price of commodity 2 (in terms of commodity 1) and let us assume that when the economy opens up to trade $p_2(0) > P_2(0)$. Comparative advantage leads the economy to complete specialisation in commodity 1. At time t, the economy may be described by the following system of equations:

$$(1') \quad p_1(t) \cdot Q_1(t) = L_1(t) \cdot w(t)$$

$$(2') \quad P_2(t) = P_2(0) \cdot e^{\beta t}$$

$$(3') \quad p_1(t) \cdot C_1(t) = \alpha(t) \cdot L(t) \cdot w(t)$$

$$(4') \quad p_1(t) \cdot X_1(t) = p_1(t) \cdot Q_1(t) - p_1(t) \cdot C_1(t)$$

$$(5') \quad P_2(t) \cdot C_2(t) = [1 - \alpha(t)] \cdot L(t) \cdot w(t)$$

$$(6') \quad L(t) = a_1(t) \cdot Q_1(t)$$

$$(7') \quad L(t) = L(0) \cdot e^{gt}$$

$$(8') \quad w^*(t) = \frac{p_1(0) \cdot C_1(t) + p_2(0) \cdot C_2(t)}{L(t)}$$

where C_1 and X_1 are the levels of internal consumption and exports of commodity 1, C_2 is the level of consumption and imports of commodity 2, w^* is again the real wage measured at the pre-trade initial prices. Notice that equations (1'), (3') and (4') imply that, at any time, the value of imports is equal to the value of exports. The international price P_2 of commodity 2 is assumed to change at a constant rate β. This rate may be zero in which case the terms of trade for the economy considered remain constant through time.

Taking commodity 1 as the numeraire and assuming the labour coefficients a_1 and a_2 as well as the demand coefficient α as known, the solutions for prices, quantities and the real wage in the two economies are as follows:

Autarky

$$(1.1)\quad p_2(t) = a_2(t)/a_1(t)$$

$$(2.1)\quad Q_1(t) = \frac{\alpha(t) \cdot L(0) \cdot e^{gt}}{a_1(t)}$$

$$(3.1)\quad Q_2(t) = \frac{[1-\alpha(t)] \cdot L(0) \cdot e^{gt}}{a^2(t)}$$

$$(4.1)\quad w^*(t) = \frac{\alpha(t)}{a_1(t)} + \frac{a_2(0)}{a_1(0)} \cdot \frac{[1-\alpha(t)]}{a_2(t)}$$

Free trade

$$(1.1')\quad P_2(t) = P_2(0) \cdot e^{gt}$$

$$(2.1')\quad Q_1(t) = \frac{L(0) \cdot e^{gt}}{a_1(t)}$$

$$(3.1')\quad C_1(t) = \frac{\alpha(t) \cdot L(0) \cdot e^{gt}}{a_1(t)}$$

$$(4.1')\quad C_2(t) = \frac{[1-\alpha(t)] \cdot L(0) \cdot e^{gt}}{a_1(t) \cdot P_2(0) \cdot e^{\beta t}}$$

$$(5.1')\quad X_1(t) = \frac{[1-\alpha(t)] \cdot L(0) \cdot e^{gt}}{a_1(t)}$$

$$(6.1')\quad w^*(t) = \alpha(t) + [1-\alpha(t)]\, p_2(0)/P_2(0) \cdot e^{\beta t}$$

Let us consider the static effects of trade in the initial period when the economy considered opens up to international trade. In time $t=0$, the total level of employment will be the same, by assumption, under autarky and free trade. In the trading economy the employment in the production of industry 1 for internal consumption will be the same as the overall employment in industry 1 under autarky [see equations) (2) and (3′) of table 1, for $t=0$]. But now the additional production for exports of industry 1, due to the absorption of the labour force previously employed in industry 2, will be able to purchase, through trade, a larger quantity of commodity 2 than was previously produced and consumed under autarky, due to the lower relative price of commodity 2 under free trade. Real income, total and per capita, will thus be larger, in period 0, under free trade than under autarky. This is the static positive gain from trade due to specialisation in the industry showing a comparative advantage in international trade.

This gain may be seen, more formally, by comparing the real wage in the initial period in the two economies. For $t=0$, the real wages under autarky $[w_A^*(0)]$ and under free trade $[w_{FT}^*(0)]$ are:

$$w_A^*(0)=\frac{\alpha(0)+[1-\alpha(0)]}{a_1(0)}$$

$$w_{FT}^*(0)=\frac{\alpha(0)+[1-\alpha(0)]\,p_2(0)/P_2(0)}{a_1(0)}$$

and since:

$$\frac{p_2(0)}{P_2(0)}>1,\ w_{FT}^*(0)>w_A^*(0)$$

As can also be seen from this comparison, the static gain from trade will be larger: *a*) the lower the relative international price of the imported commodity with respect to the relative price of that commodity under autarky; *b*) the larger the fraction of income consumed in the imported commodity.

Under the assumptions of no technical progress, constant returns to scale and uniform income elasticities of demand for the two commodities, the static gain from trade just mentioned will be the only effect of international trade (assuming constant terms of trade through time). What we shall now do is to abandon, step by step, those assumptions and investigate the implications of this abandonment. It will be seen that new and dynamic effects of international trade appear due to the implications of the pattern of specialisation on the growth path of the economy. These dynamic effects may be in the same or in an opposite direction to the initial static gain from trade and may appear to be the most important ones in the longer term.

2. THE CASE OF NON-UNIFORM TECHNICAL PROGRESS

We shall now keep the assumption of constant shares of the two commodities in consumption but introduce different rates of labour productivity growth in the two industries. In this section, we shall take these rates of growth as constant and independent of the growth of output. We shall also assume, as a first step, that the trading economy faces constant terms of trade through time so that $\beta = 0$. The above assumptions may be expressed as follows:

$$(10.2) \quad \alpha(t) = \alpha$$

$$(11.2) \quad a_1(t) = a_1(0) \cdot e^{-\varrho_1 t}$$

$$(12.2) \quad a_2(t) = a_2(0) \cdot e^{-\varrho_2 t}$$

$$(13.2) \quad P_2(t) = P_2(0)$$

where ϱ_1 and ϱ_2 are the rates of growth of labour productivity in industries 1 and 2. Under free trade, since the economy specialises in industry 1, the rate of growth of productivity in industry 2 is only a potential rate.

Substituting now expressions (10-2) to (13-2) in the equations of p. 58, we obtain the following solutions for prices, quantities and the real wage under autarky and free trade:

Autarky

$$(1.2) \quad p_2(t) = \frac{a_2(0)}{a_1(0)} \cdot e^{(\varrho_1 - \varrho_2)t}$$

$$(2.2) \quad Q_1(t) = \frac{\alpha \cdot L(0)}{a_1(0)} \cdot e^{(g+\varrho_1)t}$$

$$(3.2) \quad Q_2(t) = \frac{(1-\alpha) \cdot L(0)}{a_2(0)} \cdot e^{(g+\varrho_2)t}$$

$$(4.2) \quad w^*(t) = \frac{\alpha \cdot e^{\varrho_1 t} + (1-\alpha)\, e^{\varrho_2 t}}{a_1(0)}$$

Free trade

$$(1.2') \quad P_2(t) = P_2(0)$$

$$(2\text{-}2') \quad Q_1(t) = \frac{L(0)}{a_1(0)} \cdot e^{(g+\varrho_1)t}$$

$$(3.2') \quad C_1(t) = \frac{\alpha \cdot L(0)}{a_1(0)} \cdot e^{(g+\varrho_1)t}$$

$$(4.2') \quad C_2(t) = \frac{(1-\alpha) \cdot L(0)}{a_1(0) \cdot P_2(0)} \cdot e^{(g+\varrho_1)t}$$

$$(5.2') \quad X_1(t) = \frac{(1-\alpha) \cdot L(0)}{a_1(0)} \cdot e^{(g+\varrho_1)t}$$

$$(6.2') \quad w^*(t) = \frac{\alpha \cdot e^{\varrho_1 \cdot t} + (1-\alpha)\,[p_2(0)/P_2(0)] \cdot e^{\varrho_1 t}}{a_1(0)}$$

The consideration of non-uniform technical progress introduces dynamic effects of trade on the growth path of the economy which lead to gains or losses from international trade which are additional to the initial static gain from trade.

The solution of the model shows that the growth path of the autarkic economy is characterized by the following features: *a*) a changing structure of relative prices reflecting the different rates of technical change in the two industries; *b*) a changing structure of output, each industry growing at a rate which is the sum of the growth rate of the total labour force and the rate of growth of productivity in the industry considered (given the assumptions of unitary income and price elasticities of demand); *c*) a changing real wage at a rate which is a weighted average of the rates of growth of productivity in the two industries.

In the trading economy, the growth path shows: *a*) a constant structure of relative prices, given the assumption of constant terms of trade; *b*) a growing level of output at a rate equal to the sum of the growth rate of the labour force and the rate of productivity growth in industry 1, with exports, consumption and imports growing at this same rate; *c*) a changing real wage (starting from a higher level than in the autarkic economy, due to the static gain from trade) at a rate equal to the rate of productivity growth in industry 1.

A comparison of the paths of the real wage in the two economies shows the presence of additional dynamic gains (or losses) from international trade[4] which depend on the comparative rate of productivity growth in the industry in which the economy specialises under free trade. If $\varrho_1 > \varrho_2$, the real wage (and total output) will grow faster under free trade than under autarky. The economy has specialised in the technologically more progressive industry and the dynamic effects of trade are in the same direction as the initial static gains.

However, if $\varrho_2 > \varrho_1$, the real wage (and total output) will grow at a lower rate in the trading economy than in the autarkic economy. Free trade and static comparative advantage have led the economy to specialise in the technologically less progressive industry and this has the effect of retarding (relative to autarky) the overall rate of technical progress in the

[4] For the economy considered, not necessarily for the world economy as a whole.

economy. Having started from an initially higher level, the real wage in the trading economy will, after a certain period, fall below the level that it would have had in the autarkic economy. The dynamic effects of trade will completely offset the initial static gain and the economy will suffer dynamic losses arising from the pattern of specialisation adopted.

So far we have assumed that the trading economy faces constant terms of trade through time. In the general case, however, the rate of change of the international relative price P_2 will be different from zero. Assuming that this rate of change reflects the difference between the productivity growth rates (ϱ_1^* and ϱ_2^*) of industries 1 and 2 in the rest of the world, so that $\beta = \varrho_1^* - \varrho_2^*$, the expressions for the real wage under autarky and free trade become:

$$\textit{Autarky:} \quad w^*(t) = \frac{\alpha \cdot e^{\varrho_1 t} + (1-\alpha)\, e^{\varrho_2 t}}{a_1(0)}$$

$$\textit{Free trade:} \quad w^*(t) = \frac{\alpha \cdot e^{\varrho_1 t}}{a_1(0)} + \frac{(1-\alpha)}{a_1(0)} \cdot \frac{p_2(0)}{P_2(0)} \cdot e^{(\varrho_1 + \varrho_2^* - \varrho_1^*)\, t}$$

Comparing these two expressions, it becomes clear that the long-term advantage of the economy will coincide with static comparative advantage (specialisation in industry 1) if:

$$\varrho_1 + \varrho_2^* - \varrho_1^* > \varrho_2 \Rightarrow \varrho_1 - \varrho_1^* > \varrho_2 - \varrho_2^* \quad \text{or} \quad \varrho_1 - \varrho_2 > \varrho_1^* - \varrho_2^*$$

i.e., when the economy specialises in the industry having the comparatively larger potential rate of productivity growth.

If, however, $\varrho_2 - \varrho_1 > \varrho_2^* - \varrho_1^*$, the economy would benefit in the long term from specialising in industry 2 while static comparative advantage leads to specialisation in industry 1.

These results have striking similarities with Pasinetti's analysis of "comparative productivity-change advantage": "in order to obtain the highest possible gains from international trade, a country should specialise in producing those commodities for which it can achieve, over the relevant period of time, the highest comparative rates of growth of productivity"[5].

The point to stress, as Pasinetti also does, is that free trade may or may not lead to the specialisation which is in the longer term advantage of the economy. And that when it does not, the economy may actually suffer dynamic losses from its participation in international trade.

[5] L. Pasinetti, *op. cit.*, p. 274.

3. THE CASE OF VARIABLE RETURNS TO SCALE

We shall here continue to keep the assumption of constant consumption shares but abandon the assumption of constant returns to scale by introducing different rates of growth of labour productivity which are a function of the growth of industrial output. We shall start by assuming, as in the beginning of section 2, that the trading economy faces constant terms of trade through time. The following expressions summarise our assumptions:

$$(10.3) \quad \alpha(t) = \alpha$$

$$(11.3) \quad a_1(t) = a_1 \cdot Q_1^{-\lambda_1}(t)$$

$$(12.3) \quad a_2(t) = a_2 \cdot Q_2^{-\lambda_2}(t)$$

$$(13.3) \quad P_2(t) = P_2(0)$$

The coefficients λ_1 and λ_2 reflect the type of returns to scale considered. For:

$0 < \lambda < 1$,	we have increasing returns to scale
$\lambda = 0$,	we have constant returns to scale
$0 > \lambda > -1$,	we have decreasing returns to scale[6]

Substituting now expressions (10.3) to (13.3) in the equations of p. 58, we obtain the solutions for prices, quantities and the real wage under autarky and free trade for the present case:

Autarky

$$(1.3) \quad P_2(t) = \frac{a_2}{a_1} \cdot \frac{\left(\frac{\alpha \cdot L(0)}{a_1}\right)^{\frac{\lambda_1}{1-\lambda_1}}}{\left[\frac{(1-\alpha) \cdot L(0)}{a_2}\right]^{\frac{\lambda_2}{1-\lambda_2}}} \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1} - \frac{g\lambda_2}{1-\lambda_2}\right)t}$$

$$(2.3) \quad Q_1(t) = \left(\frac{\alpha \cdot L(0)}{a_1}\right)^{\frac{1}{1-\lambda_1}} \cdot e^{\left(\frac{g}{1-\lambda_1}\right)t}$$

[6] We use the term "decreasing returns to scale" in an informal way to indicate an inverse relationship between labour productivity and the level of output.

$$(3.3)\quad Q_2(t) = \left[\frac{(1-\alpha)\cdot L(0)}{a_2}\right]^{\frac{1}{1-\lambda_2}} \cdot e^{\left(\frac{g}{1-\lambda_2}\right)t}$$

$$(4.3)\quad w^*(t) = \frac{[\alpha \cdot L(0)]^{\frac{\lambda_1}{1-\lambda_1}}}{a_1^{\frac{1}{1-\lambda_1}}} \cdot \left[\alpha \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1}\right)t} + (1-\alpha)\, e^{\left(\frac{g\lambda_2}{1-\lambda_2}\right)t}\right]$$

Free trade

$$(1.3')\quad P_2(t) = P_2(0)$$

$$(2.3')\quad Q_1(t) = \left(\frac{L(0)}{a_1}\right)^{\frac{1}{1-\lambda_1}} \cdot e^{\left(\frac{g}{1-\lambda_1}\right)t}$$

$$(3.3')\quad C_1(t) = \alpha\left(\frac{L(0)}{a_1}\right)^{\frac{1}{1-\lambda_1}} \cdot e^{\left(\frac{g}{1-\lambda_1}\right)t}$$

$$(4.3')\quad C_2(t) = \frac{(1-\alpha)}{P_2(0)} \cdot \left(\frac{L(0)}{a_1}\right)^{\frac{1}{1-\lambda_1}} \cdot e^{\left(\frac{g}{1-\lambda_1}\right)t}$$

$$(5.3')\quad X_1(t) = (1-\alpha)\left(\frac{L(0)}{a_1}\right)^{\frac{1}{1-\lambda_1}} \cdot e^{\left(\frac{g}{1-\lambda_1}\right)t}$$

$$(6.3')\quad w^*(t) = \frac{L(0)^{\frac{\lambda_1}{1-\lambda_1}}}{a_1^{\frac{1}{1-\lambda_1}}} \cdot \left[\alpha \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1}\right)t} + (1-\alpha)\frac{p_2(0)}{P_2(0)} \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1}\right)t}\right]$$

Before considering the growth paths of the autarkic and the trading economies, it is worth observing that the presence of variable returns to scale introduces a static gain (or loss) from trade, additional to the one analysed in section 2. Indeed, solving the equation of the real wage under autarky and free trade for $t=0$, we have:

Autarky: $$w_A^*(0) = \alpha^{\frac{\lambda_1}{1-\lambda_1}} \cdot \left[\frac{L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}}$$

Free trade: $$w_{FT}^*(0) = \left[\frac{L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}} \left[\alpha + (1-\alpha)\,\frac{p_2(0)}{P_2(0)}\right]$$

Now the initial real wage under free trade is different from the initial real wage under autarky not only because the relative price of the imported commodity is lower than under autarky ($\frac{p_2(0)}{P_2(0)} > 1$, which gives rise to the static gain from trade already discussed) but also because the absorption of employment in industry 1, from industry 2, changes, under variable returns to scale, the productivity level of industry 1 (this difference is reflected in the term $\alpha^{\frac{\lambda_1}{1-\lambda_1}}$). Whether this second effect of trade on the initial real wage is positive or negative will depend on the type of returns to scale in industry 1.

If returns to scale in industry 1 are increasing ($\lambda_1 > 0$), the increase in employment in industry 1 will increase labour productivity in industry 1 and the initial real wage under free trade over and above the increase due to the lower relative price of commodity 2. This additional positive gain from trade is: $\left[\frac{L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}} (1-\alpha^{\lambda_1/1-\lambda_1})$ (which is $w^*_{FT}(0) - w^*_A(0)$ assuming $\frac{p_2(0)}{P_2(0)} = 1$). Since $\alpha < 1$, this gain from trade will be larger: *a)* the higher the returns to scale in industry 1 (the larger λ_1 is); *b)* the lower the consumption share of commodity 1 (the lower α is) since then, for a given overall labour force, the productivity gains of absorbing employment in industry 1 from industry 2 are larger; and *c)* the larger the size of the labour force [$L(0)$], since then the larger will be the increase in employment in industry 1 and the resulting productivity gains.

If, however, returns to scale in industry 1 are decreasing ($\lambda_1 < 0$), the increase in employment in industry 1 reduces labour productivity in industry 1. The additional effect on the initial real wage is then negative and tends to offset the static gain from trade derived from the lower relative price of commodity 2. On balance, the net gain from trade will be positive if:

$$\frac{w^*_{FT}(0)}{w^*_A(0)} > 1 \Rightarrow \alpha + (1-\alpha)\frac{p_2(0)}{P_2(0)} > \alpha^{\frac{\lambda_1}{1-\lambda_1}},$$

and negative if:

$$\alpha + (1-\alpha)\frac{p_2(0)}{P_2(0)} > \alpha^{\frac{\lambda_1}{1-\lambda_1}}.$$

The net gain from trade:

$$w^*_{FT}(0) - w^*_A(0) = \left[\frac{L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}} \left[\alpha + (1-\alpha)\frac{p_2(0)}{P_2(0)} - \alpha^{\frac{\lambda_1}{1-\lambda_1}}\right]$$

will be larger (or the net loss smaller): *a*) the larger the difference between the international relative price of commodity 2 and the autarky relative price of this commodity; *b*) the less the returns to scale in industry 1 decrease; *c*) the smaller the size of the labour force [$L(0)$] since then the smaller will be the increase in employment and the fall in productivity in industry 1[7]. The influence of the consumption share on the net gain from trade is ambiguous since it has opposite effects on the two elements of the net gain.

We turn now to a comparison of the growth paths of the autarkic and trading economies. This comparison yields similar results to those analysed in the previous case of different rates of technical progress in the two industries, the main difference being that the productivity growth rates ($\frac{g\lambda_1}{1-\lambda_1}$ and $\frac{g\lambda_2}{1-\lambda_2}$) are now dependent on the rate of growth of the labour force and the type of returns to scale in each industry.

The above implies that the dynamic gains or losses from international trade will depend now on the comparative returns to scale in the industry in which the economy specialises under free trade. If $\frac{g\lambda_1}{1-\lambda_1} > \frac{g\lambda_2}{1-\lambda_2}$, which implies that $\lambda_1 > \lambda_2$, the economy by specialising in industry 1, which has the highest returns to scale, will have a faster growth of the real wage and total output under free trade than under autarky.

If, on the contrary, $\lambda_2 > \lambda_1$, the trading economy specialises in the industry which has the lowest returns to scale and this pattern of specialisation will produce a retardation of the rate of growth of overall labour productivity, total output and real wages. The economy under free trade then suffers dynamic losses which tend to offset the initial static gains from trade (when they exist).

We shall now abandon the assumption of constant terms of trade through time and consider a changing relative international price P_2. Assuming that the sources of productivity change are the same (variable returns to scale) in the rest of the world as in our economy, the rate of

[7] Thus, with respect to the static effects of trade, when specialisation occurs in an increasing returns industry a large economy will gain more from trade than a small economy (given $p_2(0)/P_2(0)$). And when specialisation is in a decreasing returns industry, it is the small economy that will gain more (or lose less).

change of P_2 is $\beta = \frac{g^* \lambda_1^*}{1-\lambda_1^*} - \frac{g^* \lambda_2^*}{1-\lambda_2^*}$ where g^* is the rate of growth of the labour force in the rest of the world and λ_1^*, λ_2^* are the returns to scale coefficients in industries 1 and 2 in the rest of the world.

With $\beta \neq 0$, the expressions for the real wage under autarky and free trade become:

Autarky:

$$w^*(t) = \left[\frac{\alpha \cdot L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}} \cdot \left[\alpha \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1}\right)t} + (1-\alpha) \cdot e^{\left(\frac{g\lambda_2}{1-\lambda_2}\right)t}\right]$$

Free trade:

$$w^*(t) = \left[\frac{L(0)^{\lambda_1}}{a_1}\right]^{\frac{1}{1-\lambda_1}} \cdot \left[\alpha \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1}\right)t} + (1-\alpha)\frac{p_2(0)}{P_2(0)} \cdot e^{\left(\frac{g\lambda_1}{1-\lambda_1} + \frac{g^*\lambda_2^*}{1-\lambda_2^*} - \frac{g^*\lambda_1^*}{1-\lambda_1^*}\right)t}\right]$$

Comparing these two expressions, it is clear that the long-term advantage of the trading economy will be to specialise in industry 1 when:

$$\frac{g\lambda_1}{1-\lambda_1} + \frac{g^*\lambda_2^*}{1-\lambda_2^*} - \frac{g^*\lambda_1^*}{1-\lambda_1^*} > \frac{g\lambda_2}{1-\lambda_2}$$

$$\Rightarrow g\left(\frac{\lambda_1}{1-\lambda_1} - \frac{\lambda_2}{1-\lambda_2}\right) > g^*\left(\frac{\lambda_1^*}{1-\lambda_1^*} - \frac{\lambda_2^*}{1-\lambda_2^*}\right),$$

while the long-term advantage will be specialisation in industry 2 when:

$$g\left(\frac{\lambda_2}{1-\lambda_2} - \frac{\lambda_1}{1-\lambda_1}\right) > g^*\left(\frac{\lambda_2^*}{1-\lambda_2^*} - \frac{\lambda_1^*}{1-\lambda_1^*}\right)$$

The point again is that the best pattern of specialisation may or may not coincide with the pattern of trade induced by static comparative advantage under free trade.

It is worth noting that the best pattern of specialisation depends not only on comparative returns to scale but also on the rate of growth of the labour force relative to the growth of the labour force in the rest of the world. To see the influence of the latter let us consider the case where $\lambda_1 = \lambda_1^*$ and $\lambda_2 = \lambda_2^*$ with $\lambda_2 > \lambda_1$. Then, for a fast-growing economy ($g > g^*$), the dynamic long-term advantage will be to specialise in the industry having the highest returns to scale (industry 2), even if the economy does not have a comparative returns to scale advantage in that industry. On the contrary, for a slow growing economy ($g<g^*$), the best pattern of trade will be to specialise in the industry having the lowest returns to scale (industry 1) while taking advantage of the productivity gains in industry 2 in the rest of the world through a falling relative price of commodity 2 in the international economy.

4. THE CASE OF DIFFERENT INCOME ELASTICITIES OF DEMAND AND THE ROLE OF EFFECTIVE DEMAND

In this section we shall abandon two assumptions that we have so far mantained throughout this paper. The first change concerns the assumption of a small open economy facing no demand constraints on its volume of exports. Instead, we shall assume that, at given and constant terms of trade, the volume of exports is constrained by demand and grows at a given constant rate x. This change implies that, under the assumption of balanced trade, the model of the trading economy (see section 1) cannot now be closed by postulating an exogenously given growth rate of the employed labour force. Under the assumptions now introduced the growth of the economy is demand-constrained by the rate of growth of exports and the condition of balanced trade, and, therefore, the growth of employment is endogenous to the model and must be consistent with the exogenously given growth of exports.

The second assumption we shall drop refers to the constancy of consumption shares. Instead, we shall assume that consumer tastes change in such a way that the share of one of the commodities (commodity 1 in our example) increases through time from an initial level $\alpha(0)$ (>0) to a final level $\alpha(\infty)$ (<1) according to the following expression:

$$\alpha(t)=\frac{\gamma_1}{\gamma_2+\gamma_3\cdot e^{-rt}} \quad \text{where } r>0 \quad \alpha(0)=\frac{\gamma_1}{\gamma_2+\gamma_3} \quad \text{and} \quad \alpha(\infty)=\frac{\gamma_1}{\gamma_2}$$

In order to isolate the effects of the changes introduced, we shall assume, as we did in section 1, that there is no technical progress and that returns to scale are constant. Thus $a_1(t)=a_1(0)$ and $a_2(t)=a_2(0)$. Under these assumptions, the trading economy, with a specialisation in industry 1, may be described by the following system of equations:

$$(1) \quad p_1(t)\cdot Q_1(t)=L(t)\cdot w(t)$$

$$(2) \quad P_2(t)=P_2(0)$$

$$(3) \quad p_1(t)\cdot C_1(t)=\left(\frac{\gamma_1}{\gamma_2+\gamma_3 e^{-rt}}\right)\cdot L(t)\cdot w(t)$$

(4) $X_1(t) = X_1(0) \cdot e^{xt}$

(5) $P_2(t) \cdot C_2(t) = \left(1 - \frac{\gamma_1}{\gamma_2 + \gamma_3 e^{-rt}}\right) \cdot L(t) \cdot w(t)$

(6) $Q_1(t) = X_1(t) + C_1(t)$

(7) $L(t) = a_1(0) \cdot Q_1(t)$

(8) $w^*(t) = \frac{p_1(0) \cdot C_1(t) + p_2(0) \cdot C_2(t)}{L(t)}$

The solutions for prices, quantities and the real wage under free trade are:

(1) $P_2(t) = P_2(0)$

(2) $Q_1(t) = X_1(0) \cdot e^{xt/1 - \frac{\gamma_1}{\gamma_2 + \gamma_3 e^{-rt}}}$

(3) $C_1(t) = \frac{X_1(0) \cdot \gamma_1 \cdot e^{xt}}{\gamma_2 - \gamma_1 + \gamma_3 \cdot e^{-rt}}$

(4) $C_2(t) = X_1(0) \cdot e^{xt}/P_2(0)$

(5) $X_1(t) = X_1(0) \cdot e^{xt}$

(6) $w^*(t) = \frac{\alpha(t) + [1 - \alpha(t)] \cdot p_2(0)/P_2(0)}{a_1(0)}$

It is worth making several observations on the initial and long-term effects of free trade on the economy. The first is that, in the presence of demand constraints on the levels of output and employment, we cannot assume, as we did in previous sections, that the industry in which the economy specialises will completely absorb the employment of the disappearing industry. There may be an overall fall in employment which may or may not be reversed depending on the long-term rate of growth of the economy. When it occurs, this reduction in employment is an initial loss from trade which has to be compared with the improvement in the real wage resulting from the lower relative price of comodity 2 under free trade.

Second, the growth of output and employment is determined, under free trade, by the growth of exports and the rate of change of the consumption share of the commodity in which the economy specialises (or its income elasticity of demand). The overall growth rate is:

$$\frac{d\ln Q_1(t)}{dt} = x + \gamma_3 \cdot e^{-rt} \cdot r\left[\frac{1}{\gamma_2 - \gamma_1 + \gamma_3 \cdot e^{-rt}} - \frac{1}{\gamma_2 + \gamma_3 \cdot e^{-rt}}\right]$$

and it is higher: *a*) the higher the rate of growth of exports (x); and *b*) the higher the income elasticity of the internal demand for the commodity in which the economy specialises (the higher r is). For $r>0$, the rate of growth of the economy g_{FT} will be higher than x, approaching x as $\alpha(t)$ tends to its final value $\alpha(\infty)$. While for $r<0$, g_{FT} will be lower than x, approaching x as $\alpha(t)$ tends to $\alpha(\infty)$.

All this means that, depending on the growth of exports and the internal income elasticity of demand for commodity 1, the growth of employment and output may fall short of the growth corresponding to the autarkic economy. If this is the case, the trading economy will suffer dynamic losses over time[8].

The analysis of the rate of growth of output and employment in the trading economy leads to a third observation. Considering the alternative patterns of specialisation, and assuming that they share the same rate of growth of exports, the long-term advantage of the trading economy will be to specialise in that commodity having the highest income elasticity of internal demand (the imported commodity having, then, the lowest income elasticity of demand) since this is the pattern of specialisation which has associated the highest growth of output and employment under free trade. And when the growth rate of exports is different among industries, the best pattern of specialisation will be that for which the growth of exports and the internal income elasticity of demand are such as to maximise the growth of output and employment. It may be the case, of course, that the commodity having the highest rate of growth of exports is the same as the one that has the highest income elasticity of demand.

The final point is that, again in this case, static comparative advantage under free trade may or may not lead to the best pattern of specialisation for the trading economy.

5. FINAL COMMENTS

The analysis presented has shown that the abandonment of the traditional assumptions of no differential technical progress, constant returns to scale and uniform income elasticities of demand, has far-reaching implications for the analysis of the long-term effects of international trade. Free trade may appear then, under certain conditions, as an inferior alternative to autarky implying dynamic losses for the trading economy. At the same time, our analysis suggests that, in the absence of demand constraints on growth, there is a pattern of specialisation (not necessarily induced by free trade) that is in the best long-term advantage of the

[8] These dynamic losses will be larger under increasing returns to scale since then not only the growth of output and employment but also the growth of labour productivity and real wages will be negatively affected.

economy. This best pattern of specialisation depends much less on static comparative advantage than on such factors as the comparative potential for technical progress among industries, the type of returns to scale, the growth of the labour force and the income elasticities of demand internally and abroad.

Our analysis implies, then, that the free operation of the market does not lead, except by coincidence, to the best possible allocation of resources in the international economy, and it also suggests that the allocation of resources which is in the best interest of one country may be very different from that which is in the best interest of another country (particularly when demand constraints are present). All this may provide a way to link the theory of international trade with the real workings of the international economy.

Although it seems clear that the whole traditional theory of trade policies is in need of a radical reconsideration, to develop fully the policy implications of the present analysis would need further research. As we hinted in the text, some of these implications may be different for small and for large countries as well as for fast-growing and slow-growing economies. And some will probably coincide with those reached by previous schools of thought (such as the Latin American structuralist school or the theories of economic growth with a balance of payments constraint) as well as with the common sense of policy makers facing real and complex policy issues. In this latter respect, it may be worth quoting, as a final comment, the rationale of Japan's industrial policy given by vice-minister Ojimi, of the Japanese Ministry of International Trade and Industry (MITI), whose proposals were one of the starting points for our thinking in the analysis presented in this paper:

> "The MITI decided to establish in Japan industries which require intensive employment of capital and technology, industries that in consideration of comparative cost of production should be the most inappropiate for Japan, industries such as steel, oil-refining, petro-chemicals, automobiles, aircraft, industrial machinery of all sorts, and electronics, including electronic computers. From a short-run static view point, encouragement of such industries would seem to conflict with economic rationalism. But, from a long-range viewpoint, these are precisely the industries where income elasticity of demand is high, technological progress is rapid, and labour productivity rises fast. It was clear that without these industries it would be difficult to employ a population of 100 million and raise their standard of living to that of Europe and America..." [9].

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[9] OECD, *The Industrial Policy of Japan,* Paris, 1972, quoted by A. Singh, *Latin America and the World Economy in the 1980's: Reflections on Issues of Economic Policy,* Department of Applied Economics, University of Cambridge, 1982, pp. 8-9.