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RESEARCH INSTITUTE FOR ECONOMICS
AND BUSINESS ADMINISTRATION
KOBE UNIVERSITY

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CONTENTS

ECONOMIC POLICIES UNDER THE FLEXIBLE EXCHANGE RATE SYSTEM: A STOCK APPROACH AND A LONG-RUN GOVERNMENT BUDGET CONSTRAINT

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1. Introduction

There are two approaches to determinate foreign exchange rates under the flexible exchange rate system. One is the traditional flow approach, where foreign exchange rates are determained so as to equilibrate the balance of payments, that is, the total of the balance of current account, long-term capital and short-term capital. The other is the monetary or stock approach where the foreign exchange rate is viewed as one of the prices which equilibrates the international financial asset markets[1].

It is obvious that both approaches should be consistent internally and furthermore, that they should be consistent in relation to each other. However, we are still in search of an approach which combines the just mentioned approaches[2]. Efforts to investigate this problem are apparent in the papers by Foley [5], Turnovsky & Burmeister [14] and Karni [6], etc[3]. These papers specifically focus on the distinction and conjunction of the "beginning-of-period" equilibrium, which corresponds to stock equilibrium, and the "end-of-period" equilibrium, which corresponds to flow equilibrium.

In this paper, we would like to set up a macroeconomic open model using a beginning of period equilibrium type of specification. The model is constructed to operate if the stock equilibrium at the beginning-of-period is satisfied (no matter which the changes in asset balances are within the period which the flow approach regards as important)[4].

We do not intend to show the superiority of the stock approach but rather wish to separate the role of the two approaches. Therefore, if we add to this model the specification to determine flow equilibriums in asset balances, we will get a complete model where stock and flow are consistently determined. One way to determine the flow variables may be to consider the transaction costs in financial markets, as suggested by Kouri [7][5].

The property that only the stock equilibrium at the beginning-of-period matters, with the assumption about real wealth, facilitates the analysis of dynamics under the flexible exchange rate system, as we will explain in the following sections. We will find that the analysis of long-run effects of monetary and fiscal policies, considering government budget constraints, becomes easier. Analysis of those problem is usually limited to a very special case, where, to avoid the complexities in more general cases, perfect capital mobility and private citizens in some countries hold only one type of foreign assets; see for example Turnovsky [12][6]. However, using our proposed model, the treatment of the problem in a more general case becomes easier.

In the following section, we set up our model, and we will obtain short-run policy effects in section 3. The dynamic policy effects will be investigated in section 4 and in the last concluding section, we will mention possible extensions of the model.

2. Model setting

We assume two types of countries, the home country and the rest of the world (foreign countries) and furthermore we aggregate the financial assets and commodities into four assets, home bonds, foreign bonds, home money and foreign money, and two goods, home goods and foreign goods. The residents in each country can hold all kinds of assets and both types of goods and we can get a market clearing condition for each asset and goods, if demand and supply functions are specified for them in either country. However, we use the usual assumption that the home country is very small and the markets of foreign goods and foreign assets are not affected by the behavior of the home residents. This assumption makes the market equilibrium conditions very simple, as will be shown later, and the assumption is not restrictive for the main conclusions of this paper.

Firstly for the home goods market, we assume the Keynesian type (fixed price and elastic) supply conditions and the output level is determined to satisfy the demand for home goods. That is,

$$(1)\quad Y=E\,(Y_d,\, i,\, W)+X(E,\, r)+G$$

where, Y is the domestic output level, E is the expenditure by home private citizens, W is home wealth, i is the interest rate for home bonds, X is the trade balance, r is the foreign exchange rate, which is the price of foreign money in terms of home money, and G is home government expenditure. Y_d is the home disposable income as follows,

$$Y_d=Y+iB^d+i^*B^*/r-T$$

where, B^d is the home demand for home bonds, B^* is the home demand for foreign bonds, i^* is the interest rate for foreign bonds and T is the home income tax. The second and third term in the right hand side of the above equation is the income by holding bonds. The income tax is assumed to be

$$T=\alpha\, Y_d+Z$$

where, α is the proportional rate of income tax and Z is a fixed part.

In equation (1), expenditure function E is the one usually used in many text books and wealth is explicit for the long-run analysis and we assume the following properties:

$$0<E_y\equiv\partial E/\partial Y_d<1$$
$$E_i\equiv\partial E/\partial i+(\partial E/\partial Y_d)\cdot(\partial Y_d/\partial i)<0$$
$$0<E_w=\partial E/\partial W$$

In trade balances, the Meade type import functions are assumed and in this case X is affected by the change in foreign expenditure through the change in i. But this effect is neglected as being small. Furthermore, as we are mainly interested in the long-run properties, we only consider the case of elasticity optimism as

$$0<X_r\equiv \partial x/\partial r+(\partial X/\partial E)\cdot(\partial E/\partial Y_d)\cdot(\partial Y_d/\partial r)$$

and marginal propensity to import m is assumed as

$$0<m\equiv -\partial X/\partial E<1$$

Government expenditure is assumed to be confined to home goods.

It is also assumed that the price level of goods is fixed at unity in each country and is not explicit in the equation. Therefore, some variables can be interpreted both in real and money terms, using home goods and home money.

Next, as home bonds and home money can be held by foreigner, their equilibrium conditions can be expressed as shown below. For home bonds,

$$(2)\quad B^d\,(Y,\, i,\, r^e-r,\, W)+rB^f\,(i,\, r^e-r)=B/i$$

where, B^d is the demand for home bonds by home residents and B^f is that of foreigners in terms of goods (or money) in the respective countries. B is the supply of home bonds and we assume that we can get one unit of home money as interest by holding one unit of home bonds and thus the price of home bonds is $1/i$. r^e is the expected long-run foreign exchange rate and (r^e-r) is introduced to indicate the expected capital gains by holding foreign assets. Here, we are assuming that the people expect the foreign exchange rate for the next period to be expressed by (r^e-r). As the interest rate of foreign bonds i^* is fixed, it is not shown, for the sake simplification, in the demand function.

For home money,

$$(3)\quad L^d\,(Y,\, i,\, r^e-r,\, W)+rL^f\,(i,\, r^e-r)=L$$

where, L^d is the demand for home money by home residents and L^f is that by foreigners in terms of goods (or money) in the respective countries. L is the supply of home money. We also have the demand for foreign money and foreign bonds by home residents as

$$L^*=L^*\,(Y,\, i,\, r^e-r,\, W)$$
$$B^*=B^*\,(Y,\, i,\, r^e-\mathrm{r},\, W)$$

where, both L^* and B^* are expressed in terms of home goods (or money). Here, as before, i^* is neglected.

The properties of the asset demand functions are assumed as follows. For income change

$$\partial L^d/\partial Y\equiv L^d{}_y>0,\ \partial B^d/\partial Y\equiv B^d{}_y<0,\ \partial L^*/\partial Y\equiv L^*{}_y>0,$$
$$\partial B^*/\partial Y\equiv B^*{}_y<0,\ L^d{}_y+B^d{}_y+L^*{}_y+B^*{}_y=0$$

This shows that the increase in Y increases the transaction demand for home and foreign money (because of an increase in the import demand) which is attained through decreases in demand for both home and foreign bonds, because of wealth constraint as

$$W=L^d+L^*+B^d+B^*$$

For the interest rate change in home bonds, it is assumed that the substitution effects are dominant and

$$\partial B^d/\partial i \equiv B^d{}_i > 0,\ \partial B^*/\partial i \equiv B^*{}_i < 0,\ \partial L^d/\partial i \equiv L^d{}_i < 0,$$
$$\partial L^*/\partial i \equiv L^*{}_i < 0,\ B^d{}_i + B^*{}_i + L^d{}_i + L^*{}_i = 0$$

For the change in the expected capital gains for foreign assets, the demand will shift between home and foreign assets and thus

$$\partial B^d/\partial(r^e - r) \equiv B^d{}_r < 0,\ \partial L^d/\partial(r^e - r) \equiv L^d{}_r < 0,$$
$$\partial B^*/\partial(r^e - r) \equiv B^*{}_r > 0,\ \partial L^*/\partial(r^e - r) \equiv L^*{}_r > 0$$
$$B^d{}_r + B^*{}_r + L^d{}_r + L^*{}_r = 0$$

For the wealth change, it will be natural to assume

$$\partial B^d/\partial W \equiv B^d{}_w > 0,\ \partial B^*/\partial W \equiv B^*{}_w > 0,\ \partial L^d/\partial W \equiv L^d{}_w > 0,$$
$$\partial L^*/\partial W \equiv L^*{}_w > 0,\ B^d{}_w + B^*{}_w + L^d{}_w + L^*{}_w = 1$$

For the foreign country, we assume that

$$\partial B^f/\partial i \equiv B^f{}_i > 0,\ \partial B^f/\partial(r^e - r) \equiv B^f{}_r < 0,$$
$$\partial L^f/\partial i \equiv L^f{}_i < 0,\ \partial L^f/\partial(r^e - r) \equiv L^f{}_r < 0$$

So far, we have not explicitly mentioned the time point of the asset equilibrium. However, a beginning-of-period equilibrium is implicit in the above asset demand functions. This is because, income, interest rate, expected capital gain and wealth in the functions are variables of this period (if the expected value of those variables in the following period are used, the end of period equilibrium is assumed).

Now we are in the position to demonstrate the important concept or assumption of wealth in our model. The wealth which enters in the asset demand functions and expenditure functions is assumed as (at time point t),

$$W_t = \int_0^t S_{t-1}\, dt$$

and

$$S_t = Y_{d_t} - E_t$$

where, S is the accumulation of financial assets and subscript t of W, S, Y_d, E indicates the time point or period. S is defined as the part of disposable income not spent on goods, which is the current account plus the new issue of financial assets by the home government.

Our definition of wealth is different from the usual one, based on capital gains or losses. As W or S is held in the form of financial assets, the value of the same portfolio may be different at different time points and the portfolio itself can be reshuffled through the time. Therefore, wealth including capital gains can not be defined as the summation of past S (which is the increment of wealth). Our definition of wealth is rather similar to the concept of "permanent income" in a certain sense.

People are mainly concerned with increasing their wealth by S and capital gains or losses are considered as transitory, even if the portfolio behavior depends on them. We assume that portfolio investors divide the permanent part of wealth into different kinds of assets and the transitory part of wealth is kept by a precautionary motive in the form of an asset which is outside our model.

We can determine at time t the value of Y, i and r from three market clearing equations (1), (2) and (3), given W, B, L, r^e, α, Z, G and i^*. The intuitive explanation of our model is as follows. At the beginning of the time period t, W is reshuffled into L^d, L^*, B^d and B^*, considering i, i^* and r, which are determined to equilibrate the asset markets. The output level is determined by the effective demand. Dynamic changes in all variables are determined if the change of W (which is saving), B, L, r^e, α, Z, G and i^* (which is given at time t) are specified. We can disregard the components of saving (flow of assets) as mentioned before.

3. Short-run analysis

In this section, we investigate the short-run (one period) policy effects on the domestic products, for a certain time period. From equations (1)–(3), using definitions of Y_d and T, we can get the following relations.

$$\begin{pmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha) & (m-1)E_i & -X_r \\ B^d{}_y & B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f \\ L^d{}_y & L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f \end{pmatrix} \begin{pmatrix} dY \\ di \\ dr \end{pmatrix}$$

$$= \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} dG + \begin{pmatrix} E_y(m-1)/(1+\alpha) \\ 0 \\ 0 \end{pmatrix} dZ + \begin{pmatrix} 0 \\ 1/i \\ 0 \end{pmatrix} dB + \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} dL + \begin{pmatrix} (1-m)E_w \\ -B^d{}_w \\ -L^d{}_w \end{pmatrix} dW$$

where, subscript t, indicating the time period, is neglected for all variables. The elements of the left hand side matrix are assumed to have the signs:

$$\begin{pmatrix} + & + & - \\ - & + & + \\ + & - & + \end{pmatrix}$$

and the determinant of this matrix Δ is positive from a stability condition.

Comparative statics of this system give us the following relations, for domestic output level[7):

$$(dY/dG)=\frac{1}{\Delta}\begin{vmatrix} B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f \end{vmatrix} >0$$

$$(dY/dZ)=\{E_y(m-1)/(1+\alpha)\}(dY/dG)<0$$

$$(dY/dB)=\frac{-(1/i)}{\Delta}\begin{vmatrix} (m-1)E_i & -X_r \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f \end{vmatrix}$$

This is positive when expenditure is not elastic for interest rate changes and we assume this situation.

$$(dY/dL)=\frac{1}{\Delta}\begin{vmatrix} (m-1)E_i & -X_r \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f \end{vmatrix} >0$$

Using the above relations, we can investigate the short-run policy effects. All policy parameters can not be determined independently as the non-private sector also has its own budget constraint

$$B+G-T=\Delta B/i+\Delta L$$

where ΔB and ΔL are new issues of home bonds and home money by the home government or the central bank. Therefore, one of the policy variables G, Z, ΔB, ΔL is not independent, assuming α is fixed.

In this paper, assuming that initially,

$$B+G-T=0$$

we only consider the following four cases:

policy (1) $dG=dZ$
policy (2) $dG=dB/i$
policy (3) $dG=dL$
policy (4) $-dB/i=dL$

Policy (1) is the tax financed government expenditure and the effects are[8]:

$$(dY/dG)_1=(dY/dG)+(dY/dZ)=\{1-E_y(1-m)/(1+\alpha)\}(dY/dG)>0$$

The effects of bond financed government expenditure, policy (2), are[9]:

$$(dY/dG)_2=(dY/dG)+i(dY/dB)>0$$

Policy (3) is the money financed government expoenditure and the effects are[10]:

$$(dY/dG)_3=(dY/dG)+(dY/dL)>0$$

Policy (4) is an open market purchasing operation and the effects of it are[11]:

$$(dY/dL)_4=(dY/dL)-i(dY/dB)$$

$$=\frac{1}{\Delta}\begin{vmatrix}(m-1)E_i & -X_r \\ B^d{}_i+rB^f{}_i+L^d{}_i+rL^f{}_i & B^d{}_r+rB^f{}_r+B^f+L^d{}_r+rL^f{}_r+L^f\end{vmatrix}$$

This is positive as $(B^d{}_i+rB^f{}_i+L^d{}_i+rL^f{}_i)$ is normally positive and $(B^d{}_r+rB^f{}_r+B^f+L^d{}_r+rL^f{}_r+L^f)$ is normally negative.

The above policy effects are limited to the short-run. This is because in the above four policies the government budget constraint is imposed only for the period concerned. The constraint may not be satisfied in the following periods as tax receipts and interest payments change. If we put the constraint for all periods, the policy effects will be different. In the next section we will take this point into account, following Turnovsky [12][12].

4. Long-run analysis

The analysis in the previous section concerns the sort-run in the sense that variables W, B, L, r^e, α, G and Z are assumed to be given or determined as policy variables. However, W is changing over the time and B and/or L (α, G, Z) must change over the time so as to maintain the government budget constraint[13]. A long-run equilibrium is attained when those variables stay constant and thus we will get the following conditions, in addition to the short-run market equilibrium conditions (1)–(3).

$$(4)\quad S=Y_d-E\,(Y_d,\, i,\, W)=0$$

$$(5)\quad B+G-(\alpha\, Y_d+Z)=0$$

It must be noted here that in our long-run analysis, real capital accumulation is neglected and this is a strong limitation of our model in the application for actual purposes.

Specifying the policy rules to finance the government budget constraint, we only investigate the following four long-run policies, policy (I), (II), (III) and (IV), which seem to correspond to policy (1), (2), (3) and (4), respectively.

Policy (I) $dG=dZ$: L is fixed and B is an endogenous variable.
The effect on the output level is expressed as $(dY/dG)^B{}_I$

Policy (II) dG: L and Z are fixed and B is an endogenous variable; $(dY/dG)^B{}_{II}$
$dG=dB$: L is fixed and Z is an endogenous variable; $(dY/dG)^Z{}_{II}$

Policy (III) dG: B and Z are fixed and L is an endogenous variable; $(dY/dG)^L{}_{III}$
$dG=dL$: B is fixed and Z is an endogenous variable; $(dY/dG)^Z{}_{III}$

Policy (IV) dL: G and Z are fixed and B is an endogenous variable; $(dY/dL)^B{}_{IV}$
$dL=-dB$: G is fixed and Z is an endogenous variable; $(dY/dL)^Z{}_{IV}$

From the equations (1)–(5), we will get the following relations when W and B are also endogenous variables.

$$(6)\quad \begin{pmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)\,(1-m)/(1+\alpha) & (m-1)E_i & -X_r & (m-1)\,(E_w+E_yY_w) & 0 \\ B^d{}_y & B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & -1/i \\ L^d{}_y & L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ (E_y-1)\,(1+iB^d{}_y)/(1+\alpha) & E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & 0 \\ (1+iB^d{}_y)\,\alpha/(1+\alpha) & \alpha Y_i & \alpha Y_r & \alpha Y_w & -1 \end{pmatrix} \begin{pmatrix} dY \\ di \\ dr \\ dW \\ dB \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{pmatrix} dG + \begin{pmatrix} E_y(m-1)/(1+\alpha) \\ 0 \\ 0 \\ (E_y-1)/(1+\alpha) \\ -1+\alpha/(1+\alpha) \end{pmatrix} dZ + \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{pmatrix} dL$$

where, $Y_r=\partial Y_d/\partial_r$ (with Y, i, W and B are constant), $Y_w=\partial Y_d/\partial_w$ (with Y, i, r and B are constant), $Y_i=\partial Y_d/\partial i$ (with Y, r, W and B are constant).

Let us investigate the stability of the dynamic adjustment system in the case where the home bond supply changes to keep the government budget constraint and is an endogenous variable[14]. Combined with the accumulation of wealth, the system can be formulated as:

$$\dot{W}=Y_d-E(Y_d,\ i,\ W)$$
$$\dot{B}=(B+G-T)\ i$$

We know that Y_d, i and T depend on W and B, using static equilibrium relations, when L, r^e, α, G and Z are given. Here, we must note that without the assumptions for wealth in section 2, dynamic adjustment equations for the components of W are required. Linearizing around the equilibrium value, we get the following characteristic equation:

$$\begin{vmatrix} (1-E_y)\partial Y_d/\partial W-E_i\partial i/\partial W-E_w-R & (1-E_y)\partial Y_d/\partial B-E_i\partial i/\partial B \\ -i\alpha\partial Y_d/\partial W & (-\alpha\partial Y_d/\partial B+1)\ i-R \end{vmatrix}=0$$

Where, $\partial Y_d/\partial W$, $\partial i/\partial W$, $\partial Y_d/\partial B$ and $\partial i/\partial B$ are determined from the comparative statics in the short-run model. For stability, the real part of the roots R must be negative and we get the following two conditions:

(i) $\{(1-E_y)\partial Y_d/\partial W-E_i\partial i/\partial W-E_w\}+i\ \{1-\alpha\partial Y_d/\partial B\}<0$

(ii) $\begin{vmatrix} (1-E_y)\partial Y_d/\partial W-E_i\partial i/\partial W-E_w & (1-E_y)\partial Y_d/\partial B-E_i\partial i/\partial B \\ -\alpha\partial Y_d/\partial W & 1-\alpha\partial Y_d/\partial B \end{vmatrix}>0$

As for condition (i), the first term will be negative because it is reasonable to assume that the effects of E_w outweigh those of $\partial Y_d/\partial W$ (which is positive) and $\partial i/\partial W$ is negative. However, usually $\alpha\partial Y_d/\partial B$ is not larger than 1 and the second term is positive and, possibly, the stability condition is not satisfied.

For condition (ii), if α is not large enough, this stability condition is not satisfied and even if α is large, there is a strong destabilizing factor:

$$\{(1-E_y)\partial Y_d/\partial W-E_i\partial i/\partial W-E_w\}\ \{1-\alpha\partial Y_d/\partial B\}$$

Therefore, the adjustment of the above case seems unstable, except in some special cases. These are fully investigated in Christ [3][15].

Assuming a special stable case, let us investigate the policy effects. Intuitively we can see as follows. As α is positive, tax receipt has increased if Y has increased by the policies in the short-run. In this case, B must be decreased to maintain the government budget constraint, in the long-run. Therefore, the incease in output level in the long-run will be smaller than that in the short-run as (dY/dB) is assumed to be positive[16]. That is,

$$(dY/dG)^B{}_I < (dY/dG)_1$$
$$(dY/dG)^B{}_{II} < (dY/dG)_2$$
$$(dY/dL)^B{}_{IV} < (dY/dL)_4$$

When Z is an exdogenous variable, instead of B, we will get the following relations from equations (1)–(5),

$$(7)\quad \begin{pmatrix} \cdots\cdots & -E_y(m-1)/(1+\alpha) \\ \cdots\cdots & 0 \\ \cdots\cdots & 0 \\ \cdots\cdots & -(E_y-1)/(1+\alpha) \\ \cdots\cdots & 1-\alpha/(1+\alpha) \end{pmatrix} \begin{pmatrix} dY \\ di \\ dr \\ dW \\ dZ \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{pmatrix} +dG \begin{pmatrix} 0 \\ 1/i \\ 0 \\ 0 \\ 1 \end{pmatrix} dB+ \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \\ 0 \end{pmatrix} dL$$

Where, the elements of the first, second, third and fourth columns of the matrix are the same as those in equation (6).

The dynamic adjustment system in this case can be formulated as:

$$\dot{W} = Y_d - E(Y_d, i, W)$$
$$\dot{Z} = B + G - (\alpha Y_d + Z)$$

The local stability conditions are:

(iii) $\{(1-E_y)\partial Y_d/\partial W - E_i \partial i/\partial W\} - (1+\alpha\partial Y_d/\partial Z) < 0$

(iv) $\begin{vmatrix} (1-E_y)\partial Y_d/\partial W - E_i\partial i/\partial W - E_w & (1-E_y)\partial Y_d/\partial Z - E_i\partial i/\partial Z \\ -\alpha\partial Y_d/\partial W & -1-\alpha\partial Y_d/\partial Z \end{vmatrix} > 0$

Where, $\partial i/\partial Z$ and $\partial Y_d/\partial Z$ are determined by the comparative statics in the short-run model. We can easily find the stable cases for the reasonable values of the parameters. This is because the minus Z in the right hand side of the adjustment equations of Z.

As we know that $(dY/dG)_2$, $(dY/dG)_3$ and $(dY/dL)_4$ are all positive, Z must be decreased to keep the government budget constraint, when α is positive, and thus an increase in Y in the long-run will be larger for policy (II), (III) and (IV), than the corresponding ones[17].

That is:

$$(dY/dG)^Z{}_{II} > (dY/dG)_2$$
$$(dY/dG)^Z{}_{III} > (dY/dG)_3$$
$$(dY/dL)^Z{}_{IV} > (dY/dL)_4$$

When we have investigated the bond financed fiscal or monetary policies in the long-run in the previous chapters in Part Three, we have implicitly assumed that Z is an endogenous variable and α is zero. That is, the short-run policy effect on the domestic output level does not change the tax receipt and thus the government budget constraint, importantly, in the long-run.

When L is an endogenous variable, instead of B or Z, we will get the following relations for comparative statics:

(8) $$\begin{pmatrix} \cdots\cdot & 0 \\ \cdots\cdot & 0 \\ \cdots\cdot & -1 \\ \cdots\cdot & 0 \\ \cdots\cdot & 0 \end{pmatrix} \begin{pmatrix} dY \\ di \\ dr \\ dW \\ dL \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 0 \\ 0 \\ 1 \end{pmatrix} dG$$

where, the elements of the only fifth column of the matrix are different from the previous one.

The dynamic adjustments where the home money supply is endogenous to maintain the government budget constraint can be formulated as:

$$\dot{W} = Y_d - E(Y_d, i, W)$$
$$\dot{L} = B + G - T$$

The local stability conditions are:

$$\text{(v)} \quad \{(1-E_y)\partial Y_d/\partial W - E_i\partial i/\partial W - E_w\} - \alpha\partial Y_d/\partial L < 0$$

$$\text{(vi)} \quad \begin{vmatrix} (1-E_y)\partial Y_d/\partial W - E_i\partial i/\partial W - E_w & (1-E_y)\partial Y_d/\partial L - E_i\partial i/\partial L \\ -\alpha\partial Y_d/\partial W & -\alpha\partial Y_d/\partial L \end{vmatrix} > 0$$

where, $\partial Y_d/\partial L$ and $\partial i/\partial L$ are determined by the comparative statics in the short-run model. It is reasonable that these conditions are satisfied and the system is stable. And in this case, the policy effects derived from comparative statics have their meanings[18].

We now find that the stability of the dynamic system mostly depends on how the government budget constraint is maintained. Therefore, we must be careful about the conclusions obtained in the short-run analysis, if we want to infer the long-run.

5. Some remarks

Although, in this paper, we have restricted the analysis to the pure flexible exchange rate system, it is not difficult to extend our model to the fixed or managed float exchange rate system in which, however, the asset demand functions will be modified, because the foreign exchange risk will be reduced and government interventions must be taken into account.

Our analysis of policy effects in this paper is rather formal, because our main interest is not in those effects but in model setting which provides simple macroeconomic relations. We can investigate more fully the policy effects and include different kinds of policies.

We have used the stock approach in this paper, but the stock approach is not sufficient for a full economic analysis. This is because the determinations of the flow of financial assets are also important, particularly in the adjustment processes. We have shown in this paper that the stock approach alone can explain most of the dynamic effects of economic policies, with some assumptions about wealth. However, we admit that these assumptions are rather strong and the flow approach can help our model much. We need the adjustment behavior of asset balances, which are flow of assets. As already mentioned in the introductory section, we need a model to combine stock and flow approaches.

Our assumption, which ignores the capital gains and losses in financial wealth, is meant mainly to facilitate the analysis of dynamic adjustment. This may be permitted as, without this assumption, the adjustment process becomes too complicated and meaningful conclusions difficult to obtain. The other assumption of neglecting real capital accumulation had better be removed to make the model realistic. However, including real capital in wealth does not seem to be very difficult.

Note:

1) The most extream view of this has been expressed by Mussa [8]. He has applied the efficient mar-

ket theory of the determination of asset prices.

2) Ethier [4] has a same intention, see pp. 276–280.

3) We are not very interested in their mathematical treatment, but their ideas.

4) It is useful to see Allen & Kenen [1], pp. 34–40.

5) Kouri [7], p. 281.

6) Turnovsky [12]. pp. 251–262.

7) For domestic interest rates and foreign exchange rates, we will get the follows.

$$(di/dG)=\frac{-1}{\Delta}\begin{vmatrix} B^d{}_y & B^d{}_r+rB^f{}_r+B^f \\ L^d{}_y & L^d{}_r+rL^f{}_r+L^f \end{vmatrix}>0$$

$$(dr/dG)=\frac{1}{\Delta}\begin{vmatrix} B^d{}_y & B^d{}_i+rB^f{}_i \\ L^d{}_y & L^d{}_i+rL^f{}_i \end{vmatrix}$$

This is negative as normally $(B^d{}_i+rB^f{}_i)L^d{}_y$ is larger than $(L^d{}_i+rL^f{}_i)B^d{}_y$ and we assume this situation

$$(di/dZ)=\{E_y(m-1)/(1+\alpha)\}\ (di/dG)<0$$

$$(dr/dZ)=\{E_y(m-1)/(1+\alpha)\}\ (dr/dG)>0$$

$$(di/dB)=\frac{1}{i\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha) & -X_r \\ L^d{}_y & L^d{}_r+rL^f{}_r+L^f \end{vmatrix}>0$$

$$(dr/dB)=\frac{-1}{i\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)\ (1-m)/(1+\alpha) & (m-1)E_i \\ L^d{}_y & L^d{}_i+rL^f{}_i \end{vmatrix}>0$$

$$(di/dL)=\frac{-1}{\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)\ (1-m)/(1+\alpha) & -X_r \\ B^d{}_y & B^d{}_r+rB^f{}_r+B^f \end{vmatrix}$$

This is negative, assuming $\{1-E_y(1+iB^d{}_y+i^*B^*{}_y)\,(1-m)/(1+\alpha)\}\ (B^d{}_r+rB^f{}_r+B^f)$ is larger than $B^d{}_r\ X_r$.

$$(dr/dL)=\frac{1}{\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)\,(1-m)/(1+\alpha) & (m-1)E_i \\ B^d{}_y & B^d{}_i+rB^f{}_i \end{vmatrix}>0$$

The effects of a change of W are as follows and they will be used for the long-run analysis.

$$(dY/dW)=(1-m)\ E_w(dY/dG)-iB^d{}_w(dY/dB)-L^d{}_w(dY/dL)$$

$$(di/dW)=(1-m)\ E_w(di/dG)-iB^d{}_w(di/dB)-L^d{}_w(di/dL)$$

$$(dr/dW)=(1-m)\ E_w(dr/dG)-iB^d{}_w(dr/dB)-L^d{}_w(dr/dL)$$

8) We also get the follows.

$$(di/dG)_1=(di/dG)+(di/dZ)=\{1-E_y(1-m)/(1+\alpha)\}\ (di/dG)>0$$

$$(dr/dG)_1=(dr/dG)+(dr/dZ)=\{1-E_y(1-m)/(1+\alpha)\}\ (dr/dG)<0$$

The following is an intuitive explanation of the relations $(dY/dG)_1$, $(di/dG)_1$ and $(dY/dG)_1$; when G is increased through the increase in Z by the same value, the initial increase in effective demand is $\{1-E_y(1-m)/(1+\alpha)\}\ dG$. This increase in effective demand increases Y and this, in turn, decreases B^d and i will increase to equibriate the home bond market. The increase in Y increases L^d and r will decrease to reduce the demand for home money.

9) We also get the follows.

$$(di/dG)_2=(di/dG)+i\ (di/dB)>0$$

$$(dr/dG)_2=(dr/dG)+i\ (dr/dB)$$

$$=\frac{1}{\Delta}\begin{vmatrix} B^d{}_y+E_y(1+iB^d{}_y+i^*B^*{}_y)\ (1-m)/(1+\alpha)-1 & B^d{}_i+rB^f{}_i+(1-m)E_i \\ L^d{}_y & L^d{}_i+rL^f{}_i \end{vmatrix}$$

The sign $(dr/dG)_2$ is ambiguous.

The intuitive explanation of policy (2) is as follows. The increase in G increases Y, i and decreases r as in policy (1). We now have additional effects through the increase in B for policy (2). When the supply of home bonds B is increased, i will increase to increase demand for home bonds and r will increase to offset the reduction of the demand for home money through the increase in i. Increases in i and r have opposite effects on Y, but from our assumption that E_i is small, Y will increase. Therefore, the total effects of policy (2) are increases in Y and i. The change in r is ambiguous.

10) We also get the follows.

$$(di/dG)_3=(di/dG)+(di/dL)$$

$$=\frac{1}{\Delta}\begin{vmatrix} L^d{}_y+E_y(1+iB^d{}_y+i^*B^*{}_y)\ (1-m)/(1+\alpha)-1 & L^d{}_r+rL^f{}_r+L^f+X_r \\ B^d{}_y & B^d{}_r+{}_rB^f{}_r+B^f \end{vmatrix}$$

The sign $(di/dG)_3$ is ambiguous.

$$(dr/dG)_3=(dr/dG)+(dr/dL)$$
$$=\frac{1}{\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha)-L^d{}_y & (m-1)E_i-L^d{}_i-rL^f{}_i \\ B^d{}_y & B^d{}_i+rB^f{}_i \end{vmatrix}$$

This is positive as $\{1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha)-L^d{}_y\}$ is normally positive. The intuitive explanation of policy (3) is as follows. The increase in G increases Y, i and decreases r and the increase in L increases Y, r and decreases i. The effects on r through L is direct and strong and assumed to outweigh the effects through G, and r will increase.

11) We also get the follows.

$$(di/dL)_4=(di/dL)-i\,(di/dB)$$
$$=\frac{-1}{\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha) & -X_r \\ L^d{}_y+B^d{}_y & L^d{}_r+rL^f{}_r+L^f+B^d{}_r+rB^f{}_r+B^f \end{vmatrix}$$

this is negative, assuming that $L^d{}_y+B^d{}_y$ is positive.

$$(dr/dL)_4=(dr/dL)-i\,(dr/dL)$$
$$=\frac{1}{\Delta}\begin{vmatrix} 1-E_y(1+iB^d{}_y+i^*B^*{}_y)(1-m)/(1+\alpha) & -X_r \\ L^d{}_y+B^d{}_y & L^d{}_i+rL^f{}_i+B^d{}_i+rB^f{}_i \end{vmatrix}$$

The sign of this is ambiguous. The intuitive explanation of policy (4) is as follows. The decrease in B decreases Y, i and r and increase in L increases Y, r and decreases i and thus, i decreases definitely. The effects on Y through L is normally stronger than those through B because by the increase in i a decrease in the home money demand is normally smaller than an increase in the home bond demand. Therefore Y will increase.

12) He wrote many related papers on this point. See Turnovsky [11] and [13].

13) The changes in the compositions of W and the prices of assets are also important, but they are not explicit in our analysis.

14) This problem becomes famous by the paper Blinder & Solow [2].

15) Christ [3], pp. 68–69. See also Scarth [9], pp. 17–19 and [10], p. 150.

16) The long-run comparative statics in the case of B is endogenous gives us rather complicated results as follows. We just show them and do not investigate them fully, because they are not important cases.

$$(dY/dG)^B{}_I=\frac{1}{\Delta_B}\Bigg[(1+E_y(m-1)/(1+\alpha))\Delta_{B,11}-(1-E_y)/(1+\alpha)\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w \end{vmatrix}$$
$$-(1/i)\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) \\ L^d{}_i+rL^f{}_i & L^d{}_r+L^f{}_r+L^f & L^d{}_w \\ ((1-E_y)Y_i+E_i)\alpha/(1+\alpha) & 0 & E_w\alpha/(1+\alpha) \end{vmatrix}\Bigg]$$

$$(dY/dG)^B{}_{II}=\frac{1}{\Delta_B}\Bigg[\begin{vmatrix} B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & -1/i \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & 0 \\ \alpha Y_i & \alpha Y_r & \alpha Y_w & -1 \end{vmatrix}$$
$$+\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & 0 \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & -1/i \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & 0 \end{vmatrix}\Bigg]$$

$$(dY/dL)^B{}_{IV}=\frac{1}{\Delta_B}\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & 0 \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & -1/i \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & 0 \\ \alpha Y_i & \alpha Y_r & \alpha Y_w & -1 \end{vmatrix}$$

Where, Δ_B is the determinant of the left hand side square matrix of equation (6) and Δ_B is assumed to be positive from stability condtions. $\Delta_{B,11}$ is a determinant of the same matrix without the first row and the first column, and is positive from stability conditions.

17) We use Δ_Z for the determinant of the matrix of the left hand side of equation (7) and use $\Delta_{Z,11}$ for the determinant of the same matrix without first row and the first column. Both Δ_Z and $\Delta_{Z,11}$ are assumed to be positive from stability conditions. The long-run comparative statics are as follows.

$$(dY/dG)^Z{}_{II}=\frac{1}{\Delta_Z}\begin{vmatrix} 1 & (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & -E_y(m-1)/(1+\alpha) \\ 1/i & B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & 0 \\ 0 & L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ 0 & E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & -(E_y-1)/(1+\alpha) \\ 2 & \alpha Y_i & \alpha Y_r & \alpha Y_w & 1/(1+\alpha) \end{vmatrix}$$

$$=\frac{1}{\Delta_Z}\{\Delta_{Z,11}-1/i\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & -E_y(m-1)/(1+\alpha) \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & -(E_y-1)/(1+\alpha) \\ \alpha Y_i & \alpha Y_r & \alpha Y_w & 1/(1+\alpha) \end{vmatrix}$$

$$+2\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & -E_y(m-1)(1+\alpha) \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & 0 \\ L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & 0 \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & -(E_y-1)/(1+\alpha) \end{vmatrix}\}$$

Here, the first term of the right hand side corresponds to (dY/dG) and the second term corresponds to (dY/dB) in the short-run analysis. The last term is the efferts of government budget constraints in the long-run analysis.

$$(dY/dG)^Z{}_{III}=\frac{1}{\Delta_Z}\{\Delta_{Z,11}+\begin{vmatrix} (m-1)E_i & -X_r & (m-1)(E_w+E_yY_w) & -E_y(m-1)/(1+\alpha) \\ B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & 0 \\ E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & -(E_y-1)/(1+\alpha) \\ \alpha Y_i & \alpha Y_r & \alpha Y_w & 1/(1+\alpha) \end{vmatrix}+\Delta_{Z,51}\}$$

The last term $\Delta_{Z,51}$ expresses the determinant of the last term of $(dY/dG)^Z{}_{II}$ and is the effects of government budget constraints. The second term corresponds to (dY/dL) in the short-run analysis.

$$(dY/dL)^Z{}_{IV}=\frac{1}{\Delta_Z}\{(1/i)\ \Delta_{Z,21}+\Delta_{Z,31}\ -\Delta_{Z,51}\}$$

Where, $\Delta_{Z,21}$ expresses the second term determinant of the right hand side of $(dY/dG)^Z{}_{II}$ and $\Delta_{Z,31}$ expresses the second term determinant of the right hand side of $(dY/dG)^Z{}_{III}$.

18) We use Δ_L for the determinant of the matrix in the left hand side of equation (8), then the comparative statics gives us,

$$(dY/dG)^L{}_{III}=\begin{vmatrix} 1 & (m-1)E_i & -X_r & (m-1)(E_w+E_y)Y_w & 0 \\ 0 & B^d{}_i+rB^f{}_i & B^d{}_r+rB^f{}_r+B^f & B^d{}_w & 0 \\ 0 & L^d{}_i+rL^f{}_i & L^d{}_r+rL^f{}_r+L^f & L^d{}_w & -1 \\ 0 & E_i & (E_y-1)Y_r & E_w-(1-E_y)Y_w & 0 \\ 1 & \alpha Y_i & \alpha Y_r & \alpha Y_w & 0 \end{vmatrix}/\Delta_L$$

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ESTRUCTURA DE LAS VENTAJAS COMPARATIVAS Y POLITICA COMERCIAL—EL CASO DE LAS EXPORTACIONES DE PRODUCTOS INDUSTRIALES EN EL BRASIL

Shoji Nishijima

1. Introducción

La política de sustitución de importaciones que lidero la industrialización del Brasil de la posguerra permitió una rápida industrialización del sector industrial y su diversificación, llegando a su pico en los primeros años de la década del sesenta para luego estancarse hasta 1967. El cambio de gobierno en 1964 produjo un consecuente cambio en la política económica. La estabilidad política y la consistencia de las medidas económicas aplicadas en este último período permitió alcanzar un alto ritmo de crecimiento en el período 1968–73. La tasa promedio de crecimiento del P.I.B. fue del 10.2%, el de la producción industrial del 12.5%, y el de las exportaciones industriales superó al 30%.

Básicamente, al aumento de las exportaciones estuvo basado en el crecimiento de la producción industrial en general, pero es posible afirmar que la causa directa del mismo radicó en la política de promoción de exportaciones. Los trabajos de Tyler [7] y Nishimukai [5] analizan el peso de estas medidas de promoción sobre las exportaciones de productos industriales.

Una de las características fundamentales de la estructura de las exportaciones de este período es el cambio en su composición por productos y en la distribución por regiones. Tal como se ve en el cuadro 1, la participación de los productos alimenticios y productos de la industria liviana dentro de las exportaciones hacia el resto del mundo, aumentó desde el 64.3% en 1968 al 71.8% en 1973. Es necesario sin embargo notar que mientras los productos alimenticios disminuyeron desde el 47.4% al 38.1%, los productos de la industria liviana aumentaron del 16.9% al 33.7%, siendo esta tendencia mucho más fuerte para el caso de los países desarrollados. Por otro lado, los productos de la industria pesada y quimica han disminuido del 35.6% en 1968 al 28.1% en 1973, aunque dentro de dicho sector los productos quimicos y metalúrgicos han disminuido y las maquinarias y equipos han aumentado un poco. En cambio al analizar las exportaciones en el marco de la ALALC se observa que la participación de los productos de la industria pesada y química han aumentado del 63.7% al 69.7% mostrando con ello la competividad de los productos de la industria brasileña dentro del area, en especial en lo que se refiere a maquinaria y equipos, los cuales aumentaron del 35.9% al 44.9%.

Cuadro 1 Composicción de las exportaciones industriales

(%)

	Mundo		Países desarrollados		Países subdesarrollados		ALALC	
	1968	1973	1968	1973	1968	1973	1968	1973
Alimentos elaborados	47.4	38.1	61.0	32.0	22.2	38.7	12.3	5.2
Productos de la industria liviana	16.9	33.7	14.7	44.2	20.4	20.8	24.0	25.1
Productos químicos	9.3	5.5	9.8	6.1	7.9	5.5	5.0	7.7
Productos metalúrgicos	12.2	7.3	8.9	7.0	18.8	9.1	22.8	17.1
Maquinarias y equipos	14.1	15.3	5.6	10.7	30.7	26.0	35.9	44.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Fuente: U.N., Commodity Trade Statistics 1968, 1973

Notas: Para la clasificación de este cuadro se reclasificaron los puntos de SITC de la siguente manera:
Alimentos elaborados: 013, 032, 046, 047, 048, 053, 055, 061, 062, 091, 111, 112, 122
Productos de la industria liviana: 61–66, 68
Productos químicos: 5
Productos metalúrgicos: 67, 68, 69
Maquinaria y equipos: 7

Estos hechos reflejan el cambio en la estructura de las ventajas comparativas de los productos industriales brasileños en este período de crecimiento acelerado. Entre las causas que hicieron posible este cambio, se encuentran las condiciones de oferta interna, las condiciones de demanda de los mercados de exportación, etc., pero resultará mucho más productivo realizar el análisis a la luz de las políticas comerciales. En este trabajo se tratará de explicar la estructura de las ventajas comparativas de los productos industriales brasileños desde la perspectiva de la "teoría del *labor skills*" y además sacar a luz la relación entre la estructura de las ventajas comparativas y la política de comercio exterior.

2. Estructura de las ventajas comparativas de los productos industriales brasileños: Metodología de cálculo

En este trabajo el método de cálculo de la estructura de las ventajas comparativas se basará en la teoría del *labor skills* de Keesing, etc[1]. A partir de la "Paradoja de Leontief" han surgido muchos trabajos para perfeccionar la teoría de Heckscher-Ohlin y uno de estos intentos fue la teoría del *labor skills*. Se considera que el factor productivo trabajo se encuentra dividido en "trabajo especializado" (*skilled labor*) y "no especializado" (*unskilled labor*) y en función de la dotación relativa de estos factores se determina la estructura de las ventajas comparativas. Partiendo de los supuestos de que no hay movimientos internacionales del factor trabajo y de que las diferencias de ingreso per

1). Para el cálculo de la estructura de las ventajas comparativas existen un gran numero de métodos: proporción de capital-trabajo, valor agregado per cápita, etc, pero en este trabajo debido a las restricciones de materiales se ha usado la proporción de *skilled labor-unskilled labor*.

cápita reflejan diferencias en el grado de desarrollo del capital humano existente, se concluye que los países desarrollados tendrán ventajas comparativas en los bienes con alto contnido de *skilled labor* (*skilled labor intensitive*), mientras los países subdesarrollados lo tendran en bienes con alto contenido de *unskilled labor* (*unskilled labor intensitive*).

La mayoría de los trabajos empíricos han sido realizados con referencia a los EE. UU. y el primer trabajo que encontramos para el Brasil es el de Tyler [6]. Tyler utilizó dos *skill index*, (i) el *skill index* de Keesing para 46 sectores industriales de los EE.UU. y el otro (ii) calculado por el propio Tyler[2)] en base a los datos del censo industrial brasileño (del IBGE) del año 1960, esta clasificado en 21 sectores. Con estos índices Tyler calculó el contenido de *skilled labor* (*skill content*) de las exportaciones e importaciones del Brasil en 1968. Los resultados basados en estos dos índices son los siguientes.

	skill content de las exportaciones	*skill content* de las importaciones
skill index de Keesing	0.340	0.663
skill index de Tyler	7.85	8.87

Los resultados indican que el *skill content* de las importaciones es mayor que el de las exportaciones. En consecuencia los resultados empíricos comprueban que el Brasil exporta bienes *unskilled labor intensive* mientras importa bienes *skilled labor intensive*.

Sin embargo este trabajo de Tyler presenta varios puntos cuestionables con respecto a la metodología empleada.

(1) Para calcular el *skill content* de las exportaciones e improtaciones brasileñas se ha utilizado el *skill index* de Keesing, es decir, el índice correspondiente a 46 sectores industriales de los EE. UU. para el año 1960. Como es natural, existen diferencias en las técnicas productivas y en los precios relativos de los factores productivos entre EE. UU. y Brasil, y tal vez ello exagere las deferencias en las intensidades *skilled labor* entre los sectores industriales de ambos países. Posiblemente también existan diferencias en la composición de productos (*product mix*) entre ambos países. En realidad de acuerdo al resultado de los dos índices es posible observar que el órden de magnitud (relación de mayor, menor o igual) entre los *skill content* de las exportaciones e importaciones coincide en ambos índices, pero que de cualquier forma, las relaciones entre las magnitudes difieren considerablemente. Mientras con el índice de Keesing la relación (*skill content* de las importaciones/*skill content* de las exportaciones) es de 1.95, con el de Tyler la relación es de 1.13. Sin embargo, con respecto a este problema, por más que difiera

2). *El skill index* de cada una de las industrias es obtenido por:
$(3\times I+II)/(I+II+III+IV)$
para I: técnicos graduados universitario
II: operario especializado
III: operario no especializado
IV: otros
Estos índices están representados en Tyler [7], p. 320.

la intensidad de *skilled labor* utilizado en ambos países, si las intensidades de los respectivos sectores en cada país están ordenados de la misma forma, es decir que no existe reversibilidad en la intensidad entre los dos países, este tipo de aproximación será racional. Sin embargo la investigación de Tyler no realizó la comparación entre los órdenes de intensidad. El *skill index* de Tyler corresponde a 21 sectores y el de Keesing a 46, lo que implica que, mientras no se efectue una reclasificación con la misma cantidad de divisiones sectoriales, es imposible efectuar este tipo de comparación. En síntesis la legitimidad de utilizar el índice de Keesing no ha sido completamente justificada en el trabajo de Tyler.

(2) Tal como se vió anteriormente Tyler calculó el *skill index* a partir del censo del Brasil del año 1960, complementando de ese modo el índice de Keesing. Sin embargo este índice también tiene puntos cuestionables. Debido a que en Brasil estos censos se efectuan cada tantos años, Tyler tuvo que utilizar el censo de 1960 para aplicarlo a las exportaciones de 1968. Tal como se analizó en la sección 1, el Brasil experimentó en ese intervalo un considerable cambio de política económica y después de 1968 la producción industrial se expandió a pasos agigantados. En síntesis lo más razonable es pensar que durante el período 1960–68 se produjo un cambio en el grado de desarrollo del capital humano, en la tecnología, en la proporción capital-trabajo y en la de *skilled labor-unskilled labor*. Esto significa que es necesario un *skill index* que refleje en forma más precisa el *skill content* correspondiente a este período.

Considerando los problemas mencionados anteriormente, y en base al método que se indica a continuación, se calculó la estructura de las ventajas comparativas de los productos manufacturados en el Brasil. En primer lugar se calculó el *skill index* en base a los datos del censo 1970 del IBGE (este índice se llama Indice de Brasil). Como la división sectorial de este censo tiene 21 sectores menos que la división de Keesing (46 sectores), la posibilidad de que exista desviación debida a las diferencias del *product mix* es alta. En este trabajo, para cubrir estas posibles desviaciones se utilizó el índice de Hufbauer [1]. Este índice está confeccionado para 47 sectores y es mejor que los índices de Keesing y Brasil para eliminar las desviaciones debidas a las diferencias del *product mix*. Además, el índice de Hufbauer tiene una gran desagregación en el sector alimentos elaborados, que tiene una alta participacion en las exportaciones brasileñas. Por estas razones es un buen índice para el cálculo de la estructura de las ventajas comparativas.

Más aún, una de las causas principales para la utilización del índice de Hufbauer es que la reversibilidad en la intensidad de *skilled labor* es pequeña. Para la comparación de los órdenes de intensidad entre los respectivos sectores de ambos indices, en primer lugar fue necesario igualar el numero de sectores, efectuándose para ello una reclaseficación en base a la decisión sectorial del SITC (21 sectores). Luego se obtuvo la correlación por rango (en función de la intensidad de *skilled labor*) entre los índices respectivos, lo que dió una correlacion de 0.84, relativamente alta, lo que significa que la reversión de la intensidad es extremadamente pequeña, con lo cual queda probada la legitimidad del índice de Hufbauer para calcular la estructura de las ventajas comparativas de Brasil.

En resumen, estos dos índices, se han de usar de forma complementaria y si los resultados obtenidos fueran consistentes, podríamos decir que el cálculo de la estructura de las ventajas comparativas ha sido racional. En base a la metodología indicada se ha calculado el contenido de *labor skills* (*skill content*) en las exprotaciones e importaciones por regiones: Resto del mundo, Países desarrollados, Países subdesarrollados y ALALC para los años 1968 y 1973. En el cuadro 2 están representados los índices de Hufbauer y Brasil según sectores; y el índice de *skill content* para las exportaciones e importaciones está consignado en el cuadro 3.

Cuadro 2 La conexión de dos índices

	Indice de Brasil(1)	SITC	Indice de Hufbauer(2)
1. Minerales no metálicos	0.0095	66	0.0500
2. Productos metalúrgicos	0.0245	67	0.0502
		68	0.0735
		69	0.0966
3. Maquinarias y equipos	0.0486	71	0.0913
		864	0.1622
4. Equipos eléctricos y de comunicaciones	0.0501	72	0.1523
5. Equipos de transporte	0.0334	73	0.1218
6. Productos de madera	0.0063	63	0.0149
		242	0.0122
7. Muebles	0.0083	82	0.0197
8. Papel y pulpa	0.0129	64	0.0390
		251	0.0620
9. Goma y caucho	0.0265	62	0.0604
		231.2	0.1564
10. Productos de cuero	0.0149	61	0.0171
11. Productos químicos	0.0513	51	0.1564
		52	0.1564
		53	0.1075
		56	0.1564
		57	0.1564
		59	0.1564
		332	0.1468
12. Productos farmacéuticos	0.0652	54	0.1926
13. Perfumes	0.0363	55	0.1564
14. Plásticos	0.0166	58	0.1564
15. Textiles	0.0085	65	0.0208
		266	0.1124
16. Vestidos	0.0055	84	0.0102
		85	0.0066
17. Alimentos	0.0108	013	0.0179
		032	0.0330
		046	0.0180
		047	0.0180
		048	0.0180
		053	0.0330
		055	0.0330

Cuadro 2 (continuado)

		061	0.0156
		062	0.0156
		091	0.0452
		421	0.0532
18. Bebidas	0.0166	111	0.0452
		112	0.0277
19. Tabaco	0.0071	122	0.0221
20. Imprenta y libros	0.0431	892	0.0730
21. Misceláneas	0.0250	89 (−892)	0.0730
		81	0.0455
		83	0.0138
		86 (−864)	0.1622

Fuents: (1) IBGE, Censo Industrial Brasil, 1970
(2) G. C. Hufbauer [1], Tabla A-2, A-3

Notas: (a) Como en la clasificación de Hufbauer no existen los items 864 y 892 se han utilizado los *skill index* de 86 y 89 respectivamente.
(b) El índice de Brasil fué confeccionado considerando la proporción de los técnicos sobre el total de los empreados para empresas con mayor de 5 personas.
(c) En el índice de Hufbauer se tomó la proporción de los profesionales, técnicos, personales cientificos sobre el total de trabajadores.
Se basó en el censo de población de EEUU de 1960.

Cuadro 3 Skill content[1] de las exportaciones e importaciones[2]

	Indice de Brasil		Indice de Hufbauer	
	las exportaciones		las exportaciones	
	1968	1973	1968	1973
Resto del mundo	0.0210	0.0188	0.0491	0.0460
Países desarrollados	0.0173	0.0171	0.0397	0.0423
Países subdesarrollados	0.0280	0.0228	0.0668	0.0575
ALALC	0.0294	0.0317	0.0697	0.0844
	las importaciones		las importaciones	
	1968	1973	1968	1973
Resto del mundo	0.0389	0.0394	0.1100	0.1091
Países desarrollados	0.0396	0.0400	0.1116	0.1100
Países subdesarrollados	0.0320	0.0331	0.0947	0.1055
ALALC	0.0308	0.0294	0.0914	0.0837

notas: (1) El *skill content* se calculó del *skill index* de cada sector multiplicado por la participación de ese sector en el total de las exportaciones y/o importaciones.
(2) Se calculó en base al U. N., Commodity Trade Statistics (edición anual)

De acuerdo a los datos resumidos en el cuadro 3 vemos que existe una consistencia razonable en el uso complementario de ambos índices. Por ejemplo calculando la relación entre el *skill content* de las importaciones con respecto a las exportaciones (*skill content* de las importaciones/*skill content* de las exportaciones) con respecto al resto del mundo para los años 1968 y 1973, podemos observar que dicha relación es de aproximadamente 2:1 para ambos indices.

	1968	1973
Indice de Brasil	1.8523	2.0957
Indice de Hufbauer	2.2403	2.3717

Como consecuencia podemos decir que el uso de estos índices en forma complementaria, ha permitido el cálculo de la estructura de las ventajas comparativas de los productos manufactureros brasileños con un alto grado de aproximación.

3. Interpretación de los resultados

Volviendo nuevamente al cuadro 3 se ven claramente los siguientes resultados:

(1) Si comparamos el *skill content* de las importaciones con el de las exportaciones brasileños referidas a cada una de las demás áreas, para el año 1968, se observa que el correspondiente a las importaciones es mayor que el de las exportaciones. Haciendo lo propio para el año 1973 se observa que el índice de las importaciones es mayor para el resto del mundo, para los países desarrollados, para los países subdesarrollados y es menor sólo para el área de ALALC. Estos resultados coinciden con el resultado esperado al basarse en la teoría de la dotación relativa de los factores, por la cual Brasil importaría bienes *skilled labor intensive* y exportaría bienes *unskilled labor intensive.*

(2) Si obsevamos el orden del *skill content* por regiones para los dos años de referencia resulta que el

* *Skill content* de las exportaciones:
  ALALC>Países subdesarrollados>Resto del mundo>Países desarrollados
* Skill content de las importaciones:
  Países desarrollados>Resto del mundo>Países subdesarrollados>ALALC

Este resultado también apoya los postulados de la teoría de las ventajas comparativas para el caso del Brasil.

(3) El hecho que más llama la atención es el cambio ocurrido en la estructura de las ventajas comparativas desde 1968 a 1973. Como aquí se ha utilizado el mismo *skill index* para dos años, las diferencias en el *skill content* no reflejan los cambios en las características de la industria. Por lo tanto lo que aquí mencionamos como cambios en la estructura de las ventajas comparativas reflejan solamente cambios en la intensidad de *skilled labor* originados en cambios en la composición del comercio exterior. De acuerdo al *skill content* de las exportaciones hacia el resto del mundo, podemos interpretar que Brasil ha intensificado ventajas comparativas en los bienes *unskilled labor* intensivo.

	1968	1973
Indice de Brasil	0.0210	0.0188
Indice de Hufbauer	0.0491	0.0460

Por otro lado con respecto a las exportaciones hacia ALALC ha intensificado sus ventajas comparativas en los bienes *skilled labor* intensivo.

	1968	1973
Indice de Brasil	0.0294	0.0317
Indice de Hufbauer	0.0697	0.0844

Este hecho también puede observarse en la evolución de la participación porcentual de las exportaciones de la industria pesada química por regiones, pues estas exportaciones tienen un alto *skill content* (ver cuadro 1). Esta participación ha aumentado con respecto a la ALALC, especialmente en las exportaciones de maquinarias y equipos.

El punto en cuestión es determinar cuales fueron las causas que produjeron estos cambios. Esto es lo que haremos en la próxima sección, en la que analizaremos la relación entre el cambio de la estructura de las ventajas comparativas desde 1968 a 1973 y las medidas de política comercial que han incentivado la promoción de las exportaciones desde 1964.

4. Estructura de las ventajas comparativas y política comercial

Como vimos en la sección anterior, en el período 1968–73 el *skill content* de las exportaciones brasileñas hacia el resto del mundo ha disminuido, mientras que el fenómeno contrario se observó en el caso de las exportaciones a la ALALC. Existen varios factores que hicieron posible este cambio, pero aquí se tratará de analizar el punto referido a la

Cuadro 4 Las más importantes medidas de promoción de las exportaciones industriales depués de 1964

Incentivos Impositivos	
1964	Devolución de impuestos aduaneros para las materias importadas utilizadas en la producción para la exportación
1965	Exención a los sellos
1965	Exención de los impuestos sobre los productos industrializados (IPI)
1966	Exención a los impuestos a los operaciones financieras
1967	Exención de los impuestos a la renta
1967	Exención de los impuestos sobre la circulación de mercancías (ICM)
1968	Crédito impositivo del IPI
Créditos a la Exportación	
1967	Créditos concedidos por la CACEX a la producción para la exportación
1968	Créditos especiales a la exportación concedidas por la FINEX
Política de Cambios	
1964	Unificación de las tasas de cambio
1968	Apertura de *crawling peg*
Política Arancelaria	
1965–66	Abolición del *surcharge* de la importácion
1967	Rebaja de los aranceles
Otros medidas	
1964	Simplificación de los tramites para la exportación
1966	Establecimiento del CONCEX
1972	Establecimiento del BEFIEX

política comercial.

Después de 1964, en Brasil se produjo un cambio en la política comercial tomándose medidas de promoción de las exportaciones, de las cuales las más importantes se consignan en el cuadro 4. Por ejemplo si consideramos las exenciones, los créditos impositivos, los rebates, etc, en conjunto llegaron a representar un valor equivalente a un 40% de los precios internos de venta para el año 1973[3]. Por otro lado, también los impuestos a la importación han disminuido bastante desde 1964 aunque todavía se mantienen a altos niveles; así la tasa promedio de los impuestos nominales en 1973 fue del 40% para los bienes de capital, 36% para los bienes intermedios, 67% para los bienes de consumo; y debido al efecto cascada esta estructura es bastante ventajosa para la producción nacional de bienes de consumo. También se tomaron otras medidas tales como la política de cambios, créditos a la exportación, simplificación de la tramitación, servicios de comercialización ofrecidos por el gobierno, como así también diferentes tipos de medidas que sirvieron para la promoción de las exportaciones.

Dentro de todas estas medidas, las que fueron aplicadas de una manera discriminatoria fueron los impuestos a la importación y los incentivos impositivos a la exportación. Para clarificar la relación existente entre estas políticas comerciales aplicados de una manera discriminatoria con la intensidad de *skilled labor* por sector y la distribución de las exportaciones según regiones, se ha realizado un análisis de correlación, para el cual se han empleado los siguientes índices:

- BSI: Intensidad de *skilled labor* basado en el índice de Brasil,
- HSI: Intensidad de *skilled labor* basado en el índice de Hufbauer,
- ETP: Tasa de protección efectiva (12/1973),
- NTP: Tasa de protección nominal (12/1973),
- IPI: Tasa de impuesto a los productos industriales (12/1973),
- ICM: Tasa de impuesto sobre la circulación de mercancías (12/1973),
- P: Indice general de las medidas impositivas (12/1973). En este índice están incluidas las exenciones a IPI e ICM, los impuestos a la renta y los impuestos a los operaciones financieras, y la devolución del pago a los derechos aduaneros, los créditos basados en la resolución 71, etc. (Este índice fue calculado por Tyler [7]),
- LAR: La participación de las exportaciones hacia la ALALC sobre el total de las exportaciones por sector (1973),
- DCR: Idem para los países desarrollados,
- EE: La tasa del crecimiento de las exportaciones por sector desde 1968 a 1973,
- EX: La participación de las exportaciones sobre el total de la producción por sector (1973),

Cada uno de los índices mencionados anteriormente se ordenaron de mayor a menor por sector y se aplicó la correlación por rango de Spearman obteniéndose los resultados consignados en el cuadro 5.

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3). Ver Tyler [7], p. 221.

Cuadro 5 Las correlaciones por rango de Spearman por los 21 sectores

	BSI[1]	HSI[1]	ETP[2]	NTP[2]	IPI[2]	ICM[2]	P[2]	LAR[3]	DCR[3]	EE[3]
HSI	0.84									
ETP	−0.78	−0.80								
NTP	−0.79	−0.77	0.98							
IPI	−0.23	−0.21	0.37	0.41						
ICM	−0.26	−0.16	0.35	0.34	0.63					
P	0.33	0.32	−0.50	−0.46	−0.76	−0.89				
LAR	0.44	0.52	−0.45	−0.34	−0.01	−0.06	0.27			
DCR	−0.33	−0.37	0.28	0.18	0.06	0.14	−0.31	−0.08		
EE	−0.21	−0.25	0.14	0.11	0.30	0.56	−0.38	0.08	0.39	
EX	−0.06	−0.29	0.11	−0.02	−0.38	−0.23	0.07	−0.58	0.56	0.23

Notas: Valor del coeficiente para un nivel de significación del 5% es de 0.438
Fuentes: (1) Cuadro 2
(2) Tyler [7], p. 239, p. 244, p. 225
(3) U.N., Commodity Trade Statistics, 1973, 1968

De acuerdo a estos resultados podemos observar los siguientes puntos:

(1) Existe una relación inversa entre la intensidad de *skilled labor* (BSI, HSI) y la tasa de protección, es decir, a medida que la intensidad de *skilled labor* es mayor, menor es la protección aduanera recibida. Por lo tanto, la política aduanera es discriminatoria contra las industrias *skilled labor intensive*, mientras protege a las industrias *unskilled labor intensive*. Desde el punto de vista de la teoría del *labor skills* Brasil tiene ventajas comparativas en las industrias *unskilled labor intensive*, por eso, las políticas arancelarias brasileñas tendieron a reforzar aún más dichas ventajas.

(2) Aquí IPI e ICM presentan la tasa de impuestos que deberían pagar los productos en caso de que su destino fuera el mercado interno. En cambio si su destino es la exportación, existirá una exención de dichos impuestos. En síntesis al analizar los beneficios que reciben las industrias de exportación es posible afirmar que a mayor tasa impositiva, mayor será el beneficio producido por la exención. Tendiendo en cuenta estas consideraciones y en base a los datos del cuadro 5, podemos decir que no existe una correlación significativa entre la intensidad de *skilled labor* (BSI, HSI) y las cargas impositivas (IPI, ICM, P); pero si solamente cosideramos el signo del coeficiente podemos afirmar que a mayor intensidad de *skilled labor* menor es la suma exenta. Es decir, los incentivos impositivos estuvieron dirigidos a estimular la exportación de las industrias *unskilled labor intensive*. Respecto al índice P encontramos el mismo fenómeno; cuanto menor es el P, mayores son los beneficios impositivos.

En síntesis, tal como vimos, las políticas arancelaria e impositiva han beneficiado a las industrias *unskilled labor intensive*, siendo ésta una de las causas de la caída del *skill content* de las exportaciones del Brasil al resto del mundo en el período 1968–73. En otras palabras podemos interpretar que las políticas comerciales e impositivas acentuaron aún más las ventajas comparativas de las industrias *unskilled labor intensive*. También el hecho de que las industrias *unskilled labor intensive* son las que más crecieron en las exportaciones, confirma esta hipótesis.

(3) Sin embargo, ¿cuál es la cause de que el *skill content* de las exportaciones a los países de ALALC se haya elevado? La correlación entre la participación de las exportaciones por sector a los países de la ALALC (LAR) y BSI, HSI es significativa y de signo positivo, es decir que a mayor intensidad de *skilled labor*, mayor el porcentaje de exportaciones a los países de ALALC. La correlación con respecto a la política arancelaria es de signo negativo, lo que significa que las exportaciones a la ALALC fueron las que recibieron menos protección. Con respecto a la política impositiva no existe una correlación significativa. Las industrias que tienen una alta participación de las exportaciones hacia la ALALC (LAR) son aquellas justamente cuya tasa de especialización en las exportaciones (EX) es baja. Por el contrario las industrias que exportan a los países desarrollados (DCR) son aquellas cuyo grado de especialización en los exportaciones (EX) es alta.

En resumen, las industrias que tienen una alta participación de sus exportaciones a la ALALC son las industrias menos beneficiados por las políticas arancelarias e impositivas, y que además su grado de especialización en las exportaciones es baja, es decir son las industrias que todavía no han logrado desarrollarse lo suficientemente, como para llamarlas industrias de exportación, y a pesar de ello en el transcurso del período 1968–73 han incrementado sus exportaciones al área.

¿A que causas responde este hecho? Es posible pensar en otras causas no relacionados con las políticas arancelarias e impositivas. Es probable que las dos más importantes sean:

(1) El Brasil es uno de los países más desarrollados dentro de la ALALC y tiene las industrias más complejas del *industrial mix*. Más aún durante el período 1968–73 experimentó una alta tasa de crecimiento económico, lo cual elevó su posición económica dentro del área y reforzó sus ventajas competitivas con respecto al área.

(2) También debemos mencionar el rol más importante jugado por las empresas multinacionales en la exportación de productos industriales. Gracias al Acuerdo de Complementación Industrial, el comercio y la producción dentro del área se ha extendido a los productos químicos, derivados del petróleo, automóviles, equipos de oficina, etc; Pero es bien sabido que en la práctica, este tipo de transacciones, por su naturaleza, se basan en acuerdos de producción y ventas entre subsidiarias dentro de las empresas multinacionales que operan en el área. En síntesis, el Brasil es para las multinacionales la base de sus actividades productivas, es decir, las subsidiarias allí ubicadas exportan en gran escala a las subsidiarias de otros países dentro de la ALALC. Según un estudio de Müler y Morgenstern [4] para el año 1969, el 73.3 % de las exportaciones de 94 empresas de capital extranjero radicadas en latinoamérica, cuya exportación superaba los US $100.000 anuales correspondían a transacciones entre subsidiarias de la misma empresa. Por otro lado también UNCTAD [8] estimó que del total de exportaciones industriales dentro de la ALALC, el 40 % correspondió a empresas americanas.

Para analizar la relación entre las exportaciones industriales de Brasil y las empresas multinacionales, se ha calculado la correlación existente entre la participación en el mercado interno de las empresas multinacionales en cada uno de los 21 sectores

(MSS) y algunas de las variables vistas anteriormente. Se ha utilizado el método de la correlación por rango de Spearman. Los resultados están consignados en el cuadro siguiente.

	BSI	HSI	ETP	P	LAR	DCR
MSS	0.39	0.50	−0.20	0.20	0.60	−0.43

Notas:
(1) El valor del coeficiente para un nivel de significación del 5% es de 0.438.
(2) Fuente de MSS es Tyler [7] p. 52. Los otros índices son los mismos que los del cuadro 5.

De acuerdo a estos resultados es posible observar que las industrias en donde la participación de las multinacionales en el mercado es más alta corresponden a industrias *skilled labor intensive*, por otro lado corresponden a industrias cuya exportación a la ALALC es alta y que en cambio son bajas con respecto a los países desarrollados. Y por último no son tan beneficiadas por los incentivos arancelarios e impositivos. En síntesis el aumento del *skill content* de las exportaciones a la ALALC tiene una estrecha relación con la expansión de las inversiones extranjeras del período considerado, como así también con el carácter de las empresas multinacionales que transaccionan sus productos entre las propias subsidiarias radicadas en la ALALC.

5. Conclusiones

Entre 1968 y 1973 el Brasil experimentó un acelerado ritmo de crecimiento económico aumentando también sus exportaciones industriales. El interés de este trabajo fue el de analizar los cambios en la estructura de las ventajas comparativas ocurridas en este período. Para ello en primer lugar se ha calculado la estructura de las ventajas comparativas de los productos industriales para el año 1968 y 1973. Para dicho cálculo se usaron los índices de Hufbauer y de Brasil (obtenido del censo 1970 de Brasil) en forma complementaria, llegando a confirmar la teoría del *labor skills* para el caso de Brasil. Es decir, se llegó a confirmar empíricamente que Brasil tiene las ventajas comparativas en las exportaciones de los bienes *unskilled labor intensive*. Más aún en el período considerado se elevaron las ventajas comparativas en la exportación de los bienes *unskilled labor intensive* hacia el resto del mundo, mientras que, con respecto a la ALALC, aumentaron las ventajas comparativas en los bienes *skilled labor intensive*.

Una de las causas para explicar estos cambios con respecto a las exportaciones al resto del mundo fue atribuido a la política arancelaria y impositiva que promovió las exportaciones de los bienes *unskilled labor intensive*, mientras que para el caso de las exportaciones hacia la ALALC las empresas multinacionales jugaron un rol sumamente importante. Y como última conclusión es posible afirmar lo siguiente.

(1) La política comercial brasileña fue encaminada a promover la exportación de los bienes que gozaban de las ventajas comparativas.

(2) El rol de las empresas multinacionales es importante para que la estructura de las ventajas comparativas cambie de los bienes *unskilled labor intensive* a los bienes

skilled labor intensive.

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TECHNOLOGICAL PROGRESS AND CAPITAL ACCUMULATION

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1. Introduction

In this paper we extend Hicks' Neo-Austrian Growth Model[1] to the case in which .echnological progress is constant, and examine how the long-term movements of the real wage rate, labour productivity and employment of each productive process are influenced by the relation between the pattern of technological progress and the rate of capital accumulation.

This paper consists of three main parts. The first shows that real wage and labour productivity grow at the same rate and the proportion of labour input used at each stage of production remains constant if and only if technological progress is "neutral" and the rate of technological progress is equal to the rate of capital acccumulation.

The second shows where our model economy, constructed at Section 2, converges in the long-run when technical progress is neutral and the rate of technical progress is not equal to the rate of capital accumulation.

The third analizes the impact of the "once-for-all" change of the type of technological progress on the short-term working of our model economy. Here we have the case which corresponds to the "forward-biased" case in Hicks' "Capital and Time."[2]

2. Model

2.1 The Productive Process

The productive process in our model is similar to that in "Capital and Time." Suppose the scale of production and the technique of production are independent of each other (constant returns to scale). There is a construction period T which is fixed henceforth, where labour is applied at a constant rate (A_1) for building a factory. It is followed by an utilization period $m-T$, in which labour is applied at a constant rate (A_2) for producing final outputs at a constant rate (X) of the factory.
Denote

$$(1)\quad \frac{A_1}{X}\equiv a_1 \text{ and } \frac{A_2}{X}\equiv a_2$$

By the assumption of constant returns to scale, ai, $i=1, 2$, is independent of X.

There is a difference between our model and Hicks'. Technological progress oc-

1) Hicks, [1] and [2].
2) See [1] chapter 8.

curs constantly in our model. That is to say, the newest technique of production at the calender time t is,

$$(2)\quad a_1(t)=a_1(0)e^{-\alpha_1 t}$$
$$a_2(t)=a_2(0)e^{-\alpha_2 t} \qquad \alpha_1>0;\ \text{constant}$$

Let us call α_1 the saving rate of constructional labour and α_2 the saving rate of operating labour.

2.2 The Rate of Capital Accumulation and the Profit Rate

We suppose X expands at a constant rate of growth, g.

$$(3)\quad X=X_0\,e^{gt}$$

g is, henceforth, called the rate of capital accumulation, though this term is inappropriate. The level of the rate of capital accumulation reflects both the states of short-term and long-term expectations of the entrepreneur. But we suppose in this paper that short-term expectation hardly has any effect on g. That is to say, our entrepreneur does not quickly respond to the change of his economic situation. But if the latter lasts for a sufficiently long time, he comes to see his situation in a new light.

As the representative index which expresses his economic surroundings we use the profit rate, r, defined as the solution of the following equation,

$$(4)\quad -\int_0^T a_1 e^{-\alpha_1 t} w^e(\tau, t) e^{-r\tau}\, d\tau + \int_T^{m^e(t)} \{1-a_2 e^{-\alpha_2 t} w^e(\tau, t)\}\, e^{-r\tau} d\tau = 0$$

where

$a_1 \equiv a_1(0), \quad a_2 \equiv a_2(0)$

$w^e(\tau, t)$; the real wage rate which at the calender time t, our entrepreneur expects to be realized for a date $t+\tau$ in the future.

$m^e(t)-T$; planned lifetime of the factory which embodies the newest technology $(a_1e^{-\alpha_1 t}, a_2e^{-\alpha_2 t})$ at time t.

2.3 Constructional Labour (N_1), Utilizational Labour (N_2), and Final Output (Y)

On the assumptions (2) and (3), total constructional labour input (N_1), total utilizational labour input (N_2), and final output (Y) can be written respectively,

$$(5)\quad N_1(t)=\int_0^T X(t-\tau)\, a_1(t-\tau)\, d\tau$$
$$=\begin{cases} a_1X_0T & (g=\alpha_1) \\ \dfrac{a_1X_0}{g-\alpha_1}\{1-e^{-(g-\alpha_1)T}\}\, e^{(g-\alpha_1)t} & (g\neq\alpha_1) \end{cases}$$

$$(6)\quad N_2(t)=\int_T^m X(t-\tau)\, a_2(t-\tau) d\tau$$
$$=\begin{cases} a_2X_0(m-T) & (g=\alpha_2) \\ \dfrac{a_2X_0}{g-\alpha_2}\{e^{-(g-\alpha_2)T}-e^{-(g-\alpha_2)m}\}\, e^{(g-\alpha_2)t} & (g\neq\alpha_2) \end{cases}$$

$$(7)\quad Y(t)=\int_T^m X(t-\tau)d\tau$$
$$=\frac{X_0}{g}\{e^{-gT}-e^{-gm}\}e^{gt}$$

2.4 Full Employment Equilibrium

The economic lifetime of the oldest factory, $m-T$ and the real wage rate are determined by a full employment condition.

Demand for labour depends on the real wage rate. For any level of the real wage, all factories are divided into two sets. The factories in one set can earn positive quasi-rents, but the ones in the other cannot. Let us suppose only the factories of the former set can be operating. At time t, the quasi-rent from the factory which our entrepreneur started constructing at time $t-\tau(\tau>T)$ is

$$\pi\equiv 1-w(t)e^{-\alpha_2(t-\tau)}$$

For given $w(t)$, t and α_2, the relation between π and τ is illustrated in Fig. 1. Obviously only the factories whose operating period is below $m-T$ can earn positive quasi-rents. Treating t as constant, the higher $w(t)$ is, the lower the location of the curve $11'$ will be. So that, $m-T$ is shortend and it means that the demand for labour input decreases, considering (6). And we get

$$1-w(t)a_2e^{-\alpha_2(t-m)}=0 \quad \text{for each } t$$

or

$$(8)\quad w(t)=\frac{1}{a_2}e^{\alpha_2(t-m)}$$

We assume the supply of labour is constant through time. Therefore, the demand and the supply curves of labour input are illustrated in Fig. 2. Let the momentary equilibrium in the labour market be realized at each time t owing to the adjustment of the real wage rate. Then the labour market clearing wage and the economic lifetime of the oldest factory are determined simultaneously.

Fig. 1

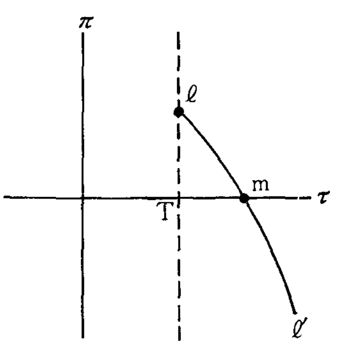
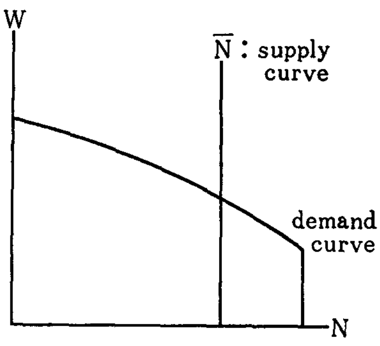


Fig. 2



But in the final output market the equality between demand and supply is not necessarily realized. Therefore, we assume that there are fiscal expenditures enough to realize the full employment equilibrium at each time t. Let $Q(t)$ be the net compensatory fiscal expenditures of the government, measured by the unit of final output. The equilibrium condition of the final market is

$$(9)\quad Y(t)=Q(t)+w(t)\,(N_1(t)+N_2(t))$$
$$=Q(t)+w(t)\,\bar{N}\quad \bar{N};\ \text{constant}$$

where $\bar{N}$; the supply of labour

and

we assume no labourer never saves his wage and the entrepreneur never consumes his income.

Needless to say, the above assumption is unrealistic. But as we said at the beginning of this paper, our main concern is mutual relationship among technological progress, the rate of capital accumulation, the real wage and labour productivity, and not, for example, the determinant of the level of effective demand. This is why we adopt such an artificial assumption.

2.5 The Type of Technological Progress

Hicks classifies the types of technological progress, according to whether the saving of labour input is partial to the early stage or the late stage of the productive process.[3)]

Our classification is based on Hicks'. Henceforth we call technological progress of the neutral, capital-saving, or capital-using type according to $\alpha_1=\alpha_2$, $\alpha_1>\alpha_2$ or $\alpha_1<\alpha_2$, respectively.

3. Steady State

Definition; Our model economy is said to be in a steady state if m never changes through time for a given g.

We can prove that our model economy is in a steady state, if and only if $g=\alpha_1=\alpha_2$

Proof of Sufficiency; There are two kinds of factories in our model economy, that is, the factories under construction and those in operation. At each time t, the factory which is being constructed at time t absorbs the additional amounts of labour,

$$a_1e^{-\alpha_1 t}\,X_0e^{gt}$$

and there are some releases of labour,

$$a_1e^{-\alpha_1(t-T)}\cdot X_0e^{g(t-T)}$$

from the factory which is brought to completion at time t. Therefore the net releases

3) See [1].

of labour inputs from the factories under construction are,

$$(10)\quad a_1X_0e^{(g-\alpha_1)t}\cdot[e^{-(g-\alpha_1)T}-1]$$

In the same way, net releases of labour inputs from the ones in operation are,

$$(11)\quad a_2X_0e^{(g-\alpha_2)t}\cdot[e^{-(g-\alpha_2)m}-e^{-(g-\alpha_2)T}]$$

If the sum of these two net released labour inputs is not zero, m must change in order to keep a full employment equilibrium. That is to say, if the sum is positive (negative), m is lengthened (shortend). But as $g=\alpha_1=\alpha_2$, both (10) and (11) are zero. Q.E.D.

The proof of necessity is easy, too. But as Section 4 in this paper itself turns to be the proof, we describe some properties of a steady state here.

A steady state is the state where there is a balance between two powers which work in the opposite direction. One of the powers consists in capital accumulation, which has the function of increasing employment. The other consists in technological progress, which has the function of decreasing employment.

Let us find the steady state solutions (m^*, w^*, N_1^*, N_2^*, Y^*). From (5), (6), the equivalent condition that $g=\alpha_1=\alpha_2\equiv\alpha$ and

$$(12)\quad \bar{N}=N_1+N_2,$$

we get

$$(13)\quad m^*=T+\frac{1}{a_1X_0}(\bar{N}-a_1X_0T)$$

Thus, in a steady state it is possible to produce final output ($m^*>T$), if and only if

$$(14)\quad \bar{N}>a_1X_0T$$

The right hand side of (14) expresses total constructional labour. With regard to other solutions, from (5), (6), (7), (8) and (13), we have

$$(15)\quad N_1^*=a_1X_0T$$

$$(16)\quad N_2^*=\bar{N}-a_1X_0T$$

$$(17)\quad w^*=\frac{1}{a_2}e^{-gm^*}e^{gt}$$

$$(18)\quad Y^*=\frac{X_0}{g}[e^{-gT}-e^{-gm^*}]e^{gt}$$

Therefore,

$$(19)\quad \left(\frac{\hat{Y}}{\bar{N}}\right)^*=\hat{Y}^*=\hat{w}^*=g=\alpha_1=\alpha_2=\hat{Q}^*$$

where the mark $\wedge$ expresses the logarithmic derivative of each variable with time t.

The last equality is derived from (9) and $\hat{Y}^*=w^*$. Let us see briefly how the steady state solutions respond to the changes in the parameters; the supply of labour, the constructional period T, and the rate of capital accumulation g.

The supply of labour $\bar{N}$; (13) shows that m^* is lengthened or shortened, according to a higher or lower $\bar{N}$. A higher $\bar{N}$ results in a lower ratio N_1^*/N_2^* and vice versa.

The constructional period T; (13) shows that the effects of changes in T on m^* depend on the ratio a_1/a_2; that is, when T is lengthened, m^* is lengthened, unchanged or shortened, according as $a_1/a_2<1$, $=1$, or 1.

The rate of captial accumulation; (19) shows that each growth rate of labour productivity, final output, and the real wage rate is equal to g.

4. The Rate of Capital Accumulation, Technological Progress and the Profit Rate — long-term trend —

It is shown in the previous section that our model economy is in a steady state if $g=\alpha_1=\alpha_2$. In this section we examine the cases where the rate of capital accumulation is different from the rates of technological progress.

Arranging g, α_1 and α_2 in order of height, we have ten cases as in Table 1. In this table the movement of m, the principal variable of our model, is shown in each case. We examine case (1) and (2) here. The other cases except for case (8) are similar though not exactly to (1) or (2). Case (8) is examined in the Appendix.

Case (1); $g>\alpha_1=\alpha_2\equiv\alpha$

Table 1

case	the movemet of m
$g>\alpha_1=\alpha_2$ (1)	$\dot{m}<0$, $m\to T$ within a finite period
$g<\alpha_1=\alpha_2$ (2)	$\dot{m}>0$, $\dot{m}\to 1$, $m\to\infty$ $(t\to\infty)$
$g<\alpha_1<\alpha_2$ (3)	$\dot{m}\to 1$ within a finite period, $m\to\infty$
$\alpha_1=g<\alpha_2$ (4)	$\dot{m}\to 1$, $m\to\infty$ $(t\to\infty)$
$\alpha_1<g<\alpha_2$ (5)	for sufficiently large t, $\dot{m}<0$, $m\to T$
$\alpha_1<\alpha_2\leqq g$ (6)	$\dot{m}<0$, $m\to T$ within a finite period
$g<\alpha_2<\alpha_1$ (7)	$\dot{m}>0$, $\dot{m}\to 1$, $m\to\infty$ $(t\to\infty)$
$\alpha_2=g<\alpha_1$ (8)	$\dot{m}>0$, $\dot{m}\to 0$, $m\to m^*<\infty$ $(t\to\infty)$
$\alpha_2<g<\alpha_1$ (9)	$\dot{m}<0$, $m\to T$ $(t\to\infty)$
$\alpha_2<g=\alpha_1$ (10)	$\dot{m}<0$, $m\to T$ within a finite period

($\dot{m}$ means $(d/dt)m$.)

(10) and (11) show that in this case the net releases of labour input from the factories under construction and those in operation are negative. Thus the real wage rises and some "marginal" factories cease to operate because they cannot earn a positive quasi-rent. Therefore from these factories some labourers are released. They amount to

$$-\dot{m}\, a_2X_0e^{-(\alpha-g)(t-m)},\quad \dot{m}<0$$

where $\dot{m}$ means $\dfrac{d}{dt}m$.

Considering full employment condition, we have

$$(20)\quad \dot{m}a_2X_0e^{-(\alpha-g)(t-m)}=a_1X_0e^{-(\alpha-g)t}\{e^{(\alpha-g)T}-1\}+a_2X_0e^{-(\alpha-g)t}\times\{e^{(\alpha-g)m}-e^{(\alpha-g)T}\}$$

or

$$(21)\quad \dot{m}=\frac{a_1}{a_2}\, e^{-(\alpha-g)m}\, \{e^{(\alpha-g)T}-1\}+\{1-e^{-(\alpha-g)(m-T)}\}\equiv\phi(m)$$

where

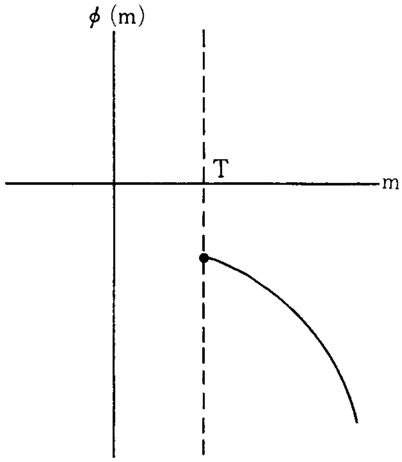
$$(22)\quad \phi(T)=\frac{a_1}{a_2}\,\{1-e^{-(\alpha-g)T}\}<0$$

$$(23)\quad \frac{d\phi}{dm}=(\alpha-g)\,[\frac{a_1}{a_2}\,\{1-e^{(\alpha-g)T}\}\,e^{-(\alpha-g)m}+e^{-(\alpha-g)(m-T)}]<0$$

$$(24)\quad \frac{d^2\phi}{dm^2}=-(\alpha-g)\frac{d\phi}{dm}<0$$

Considering these properties, $\phi(m)$ can be illustrated as in Fig. 3. Starting from any initial value m_0 ($>T$), m is shortened monotonically, and reaches T within a finite period.

Fig. 3



(5) shows that N_1 increases at constant growth rate $\alpha-g$. Thus N_2 decreases because $\bar{N}=N_1+N_2$ and $\bar{N}$ is constant.

With regard to $Y(Y/N)$ and w, we see from (7) and (8),

$$(25)\quad \hat{Y}=\left(\frac{\hat{Y}}{N}\right)=g\left\{1+\frac{\dot{m}}{e^{(m-T)g}-1}\right\}$$

$$(26)\quad \hat{w}=\alpha\cdot(1-\dot{m})$$

Noting the movement of m, mentioned above, we see

$$\hat{Y}=\left(\frac{\hat{Y}}{N}\right)>g \quad \text{for each time } t$$

$$\hat{Y}\rightarrow -\infty, \text{ when } m\rightarrow T$$

and

$$\hat{w}>\alpha \text{ for each time}$$
$$\hat{w} \rightarrow \alpha, \text{ when } m \rightarrow T$$

As a matter of fact, that $m = T$ may not be realized. Before m reaches T, our model economy may have one of the following two kinds of experiences or both.

(A) r may be getting to be zero. In order to know the movement of r, we must specify the way in which our entrepreneur forms his expectation with regard to $w^e(\tau)$ and m^e in (4). The question is what kind of expectation is "optimal" in a non-steady state. This question is difficult to answer. But the following inference may be sufficiently appropriate. In case (1), the real wage rises at the growth rate more than α and m is shortened monotonically. Thus our entrepreneur, if his expectation is strongly affected by present and past facts, may expect the real wage to continue rising and the economic lifetime of future factories to be shorter than now. If so, the expectation that the future real wage is equal to the present one and that $m^e=+\infty$ is more "bullish" than any reasonable expectation. That is to say, it is thought that the profit rate, calculated on such expectation, is higher than the profit rate caluclated on the "optimal" expectation. Therefore, if it continues to decline, the profit rate calculated on the "optimal" expectation cannot but decline, at least after the lapse of a sufficiently long time.

Substituting m^e and $w^e(\tau)$ in (4) with $+\infty$ and $w(t)$ respectively, we see

$$(27) \quad -w(t)a_1e^{-\alpha t}\int_0^T e^{-r\tau}\,d\tau+\{1-w(t)a_2\,e^{-\alpha t}\}\int_T^\infty e^{-r\tau}\,d\tau=0$$

Since

$$\int e^{-r\tau}\,d\tau=-\frac{1}{r}e^{-r\tau},$$

it follows that

$$(28) \quad 1=w(t)e^{-\alpha t}\,[a_1\,\{e^{rT}-1\}+a_2]$$

where a possitive r exists if and only if

$$1-w(t)a_2e^{-\alpha t}>0$$

Taking the logarithmic derivatives of both hand sides of (28), we get,

$$(29) \quad \dot{r}=\frac{e^{rT}-1}{T\cdot(1-A)}\{\alpha-\hat{w}\}$$

where

$$A\equiv\frac{a_2}{a_1(e^{rT}-1)+a_2}\ ,\ 0<A<1$$

Obviously if $\alpha<\hat{w}$, $\dot{r}<0$. Thus the "optimal" r may decline, too. If the rate of capital accumulation g responds elastically to the change of r, g may approach α from above.

(B) But if g does not respond so elastically, Y comes to decrease and wN to increase. Thus to keep the equality between demand and supply in the final market, Q must decrease. But if feasible Q is bounded ($Q_{\min} \leq Q \leq Q_{\max}$), after the lapse of a sufficiently long time,

$$Y < Q_{\min} + w\bar{N}$$

That is, our model economy may experience demand pull inflation.

Case (2); $g < \alpha_1 = \alpha_2 = \alpha$

In case (2) both (10) and (11) are positive. Namely there is labour surplus at each time. Contrary to case (1), the real wage falls and labour surplus is absorbed by postponing the abandonment of the oldest factory.

Owing to this postponement, the amount of labour input equal to $\dot{m} a_2 X_0 e^{-(\alpha-g)(t-m)}$ ($\dot{m}>0$) can be absorbed. In this case, with regard to the function, defined by (21), we have

$$(30) \quad \phi(T) > 0,$$

$$(31) \quad \lim_{m\to\infty} \phi(m) = 1$$

and

$$(32) \quad \frac{d\phi}{dm} \gtreqless 0, \text{ according as } \dot{m} \gtreqless 1$$

$\dot{m} > 1$ means that the factories which once stopped operating because they could not earn positive quasi-rents begin operating again. But considering their physical and technical lifetime, the economy where $\dot{m} > 1$ is not able to endure. Therefore henceforth, we concentrate on the case $\dot{m} < 1$. From (31) and (32), it is obvious that

$$\lim_{t\to\infty} \dot{m} = 1$$

and

$$\lim_{t\to\infty} m = +\infty$$

On the other hand, N_1 (N_2) decreases (increases). $\hat{Y}$ and $\hat{w}$ converge to g and zero from above respectively.[4] In this case the following two kinds of situations may happen.

(A) m cannot be lengthened infinitely because of the physical and/or technical lifetime of the oldest factory. So, at last it is getting impossible to absorb the labour surplus by further prolongation of the economic lifetime, and "technological unemployment" may occur as a final result.

(B) In this case, $\hat{Y} > g$ and wN converges to a certain constant value. Therefore the growth rate of $Q = Y - wN$ must be higher than $\hat{Y}$ to keep an equilibrium in the final market. So that, Q amounts for almost 100% of the total demand after the lapse of a sufficiently long time. If Q is bounded, ultimately

$$Y > Q_{\max} + wN$$

and "Keynesian unemployment" may occur as a final result.

It is not clear whether g may rise or not. The profit rate, defined by (4), is, as it

4) See (25) and (26).

were, the maximal rate and that this profit rate rises is one thing and that the "optimal" rate rises is another.

An encouraging factor to the rise of g is that $\hat{w}$ converges to zero. If the decline of $\hat{w}$ brings out that of expected $\hat{w}$, the "optimal" profit rate may rise.

There are two kinds of situations where our model economy may arrive after the lapse of a sufficiently long time; one is characterized by labour deficiency and other by labour surplus. In the former the rate of capital accumulation is higher than the rate of technological progress, so that, as it were, the factories under construction and one in operation begin to compete with each other for labour. It follows that the real wage rises and that old factories as they can not earn positive quasi-rents stop operating; m is shortened. As the result of the shortening of m, $\hat{Y}$ declines, though $(w\hat{N})$ rises. After the lapse of a sufficiently long time, excess demand may happen in the final output market and demand-pull inflation may occur.

The latter is contrary to the former. Owing to the fast saving of labour, the real wage rate never rises fast, so that m is lengthened and $\hat{Y}$ rises. After the lapse of a sufficiently long time, excess-supply may happen in the final output market and Keynesian or technological unemployment may occur.

We have examined the cases of the neutral technological progress in this section. As shown in Table 1, in the cases of the other biased technological progress the long-term movement of our model economy depends on whether g is higher than the lower value of α_1 and α_2, denoted by min (α_1, α_2) henceforth.

5. The change of the rate of technological progress

—short-term effect—

Whether the type of technological progress is neutral or not, our model economy reaches one of two states which are quite different from each other, according to whether the rate of capital accumulation g or min (α_1, α_2) is higher.

If the rate of capital accumulation responds elastically to the change of the profit rate, the rate of capital accumulation may fluctuate arround min (α_1, α_2) in the long-run. These are the main conclusions of section 4.

In this section we examine how the once-for-all change of the rate of technological progress affects several variables, the real wage, labour productivity, employment, etc., particularly in the short-run.

Our model economy may be adapted to the once-for-all change through the following three phases.

(i) Preparatory Phase: We suppose this change occurs at time zero. The Preparatory Phase lasts for T periods from time zero. All the factories which embody the new type of technology are under construction and never produce any final output.

(ii) Early Phase: In the Early Phase the factories which embody the new type technology begin to operate and the factories whose constructional period contains time zero operate, too.

(iii) Late Phase: In the Late Phase all the factories which embody the old type technology cases to operate.

Obviously we examined in the previous section the working of our model economy in L.P. Therefore P.P. and E.P. are the main objects of our consideration in this section.

Here we concentrate on the case where

$$\begin{pmatrix}\text{neutral technological} \\ \text{progress, } \alpha_1=\alpha_2\end{pmatrix} \longrightarrow \begin{pmatrix}\text{capital-using technological} \\ \text{progress, } \alpha_1+\Delta\alpha_1<\alpha_2+\Delta\alpha_2\end{pmatrix}$$

and that before time zero, our model economy is in a steady state ($g=\alpha_1=\alpha_2\equiv\alpha$).

Let g not change between before and after time zero. Namely we assume the change from ($\alpha\equiv\alpha_1=\alpha_2=g$) to ($\alpha+\Delta\alpha_1<g<\alpha+\Delta\alpha_2$, $\Delta\alpha_1<0$, $\Delta\alpha_2>0$) occurs at time zero. This change corresponds to Hicks' "strongly forward-biased" change of technology.[5)]

P.P.; $0\leqq t\leqq T$

Since $\Delta\alpha_1<0$ and our model economy is in a steady state before time zero, in P.P. labour deficiency occurs and m is shortened. The net releases of labour input from the factories under construction is $a_1X_0-a_1X_0e^{-\Delta\alpha_1 t}$. On the other hand, the net releases from one in operation is zero because all factories in operation in P.P. embody the old type technology ($\alpha_1=\alpha_2=\alpha$). Owing to the shortening of m, $-\dot{m}a_2X_0$ units of labour are supplied. Therefore we get $-a_2X_0\dot{m}=a_1X_0\,[e^{-\Delta\alpha_1 t}-1]$, or

(33) $$\dot{m}=\frac{a_1}{a_2}\{1-e^{-\Delta\alpha_1 t}\}\equiv\psi(t)<0$$

where

(34) $$\psi(0)=0$$

(35) $$\frac{d\psi}{dt}=\frac{a_1}{a_2}\,\Delta\alpha_1 e^{-\Delta\alpha_1 t}<0$$

(36) $$\frac{d^2\psi}{dt^2}=-\Delta\alpha_1\cdot\frac{d\psi}{dt}<0$$

With regard to $\hat{w}$ and $\hat{Y}$ ($\hat{Y}/\hat{N}$), since

(25) $$\hat{Y}=\left(\frac{\hat{Y}}{N}\right)=g\cdot\left[1+\frac{\dot{m}}{e^{g(m-T)}-1}\right],$$

and

(26) $$\hat{w}=\alpha(1-\dot{m})>\alpha$$

considering (33) and (35), $\hat{Y}=(\hat{Y}/N)$ declines and $\hat{w}$ rises monotonically from g respectively (See Fig. 4).

E.P.; $T\leqq t\leqq t_0$ where t_0 is the solution of the equation,

5) See [1] chapter 8.

$t=m(t)$.

In E.P. the net release of labour input from the factories under construction is

$$a_1X_0e^{-\Delta\alpha_1 t}\cdot[e^{\Delta\alpha_1 T}-1]<0$$

on the other hand, from the factories in operation the net releases,

$$a_2X_0[1-e^{-\Delta\alpha_2(t-T)}]>0$$

occur. In order to keep the full employment equilibrium, it is necessary that

$$a_2X_0\dot{m}=a_2X_0[1-e^{-\Delta\alpha_2(t-T)}]-a_1X_0e^{-\Delta\alpha_1 t}\cdot[1-e^{\Delta\alpha_1 T}]$$

or

$$(37)\quad \dot{m}=\{1-e^{-\Delta\alpha_2(t-T)}\}+\frac{a_1}{a_2}e^{-\Delta\alpha_1(t-T)}\cdot(1-e^{-\Delta\alpha_1 T})\equiv H(t)$$

Whether $\dot{m}$ is positive or negative is ambiguous. It may be possible that at least within a certain time interval in E.P. $\dot{m}>0$, contrary in L.P. and in P.P. We examine what condition can make $\dot{m}$ positive within a certain time interval in E.P.

With regard to the properties of function $H(T)$, we get

$$(38)\quad H(T)=\frac{a_1}{a_2}(1-e^{-\Delta\alpha_1 T})<0$$

$$(39)\quad \lim_{t\to\infty} H(t)=-\infty$$

$$(40)\quad \frac{dH}{dt}=\Delta\alpha_2 e^{-\Delta\alpha_2(t-T)}-\frac{a_1}{a_2}\Delta\alpha_1\{1-e^{-\Delta\alpha_1 T}\}e^{-\Delta\alpha_1(t-T)}$$

$$(41)\quad \frac{d^2H}{dt^2}<0$$

From (39) and (41), if the maximal value of $H(t)$ exists for $t\geqq T$,

$$(42)\quad \left.\frac{dH}{dt}\right|_{t=T}>0$$

That is, the derivatives of H, evaluted at T, are positive (see Fig. 5). Obviously, if there

Fig. 4

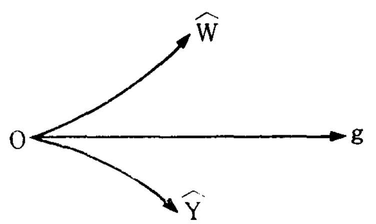
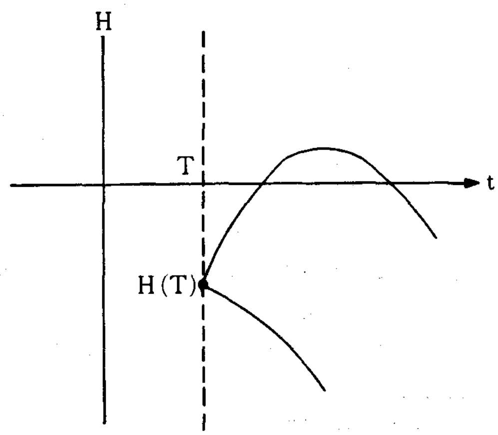


Fig. 5



is a time interval in E.P. where $\dot{m}>0$, from the right hand side of (40),

$$(43) \quad 1>\frac{a_1\Delta\alpha_1}{a_2\Delta\alpha_2}(1-e^{-\Delta\alpha_1 T})>0$$

Let us obtain the maximal value of $H(t)$ for $t \geqq T$. Solving the equation, $dH/dt=0$, with regard to t, we get,

$$(44) \quad t^*=T+\frac{1}{\Delta\alpha_1-\Delta\alpha_2}\log\left[\frac{a_1\Delta\alpha_1}{a_2\Delta\alpha_2}(1-e^{-\Delta\alpha_1 T})\right]<T$$

as the solution. Substituting this t^* with $H(t)$, we have the maximal value of $\dot{m}$,

$$(45) \quad H(t^*)=1-\left(1-\frac{\Delta\alpha_2}{\Delta\alpha_1}\right)\left\{\frac{a_1\Delta\alpha_1}{a_2\Delta\alpha_2}(1-e^{-\Delta\alpha_1 T})\right\}^{\Delta\alpha_2/\Delta\alpha_2-\Delta\alpha_1}$$

Therefore, there is a certain time interval in E.P. if and only if

$$(46) \quad 1>\left(1-\frac{\Delta\alpha_2}{\Delta\alpha_1}\right)\left\{\frac{a_1\Delta\alpha_1}{a_2\Delta\alpha_2}(1-e^{-\Delta\alpha_1 T})\right\}^{\Delta\alpha_2/\Delta\alpha_2-\Delta\alpha_1}$$

This inequality can hold if, for example, T is sufficiently short. Thus contrary to P.P. and L.P., it is possible that $\dot{m}>0$ in E.P. Then, if m is already sufficiently long before time zero, in E.P., m may be beyond the physical or technological lifetime of the factory. If so, technological unemployment may occur.

This corresponds to the effect of mechanization on employment (or the real wage) which Hicks indicates at chaper 8 of "Capital and Time", using his own model.

References

[1] Hicks, J. R., *Capital and Time: A Neo-Austrian theory.* New York and London: Oxford University Press, 1973.

[2] Hicks, J. R., "A Neo-Austrian Theory," Economic Journal, 1970.

Appendix: Case (8)

Substituting (5) and (6) into (12) and taking the logarithmic derivatives of both hand sides of (12), we get,

$$(a) \quad \dot{m}=\frac{a_1}{a_2}\{e^{-(g-\alpha_2)T}-1\}e^{(g-\alpha_1)t}$$

Since $g-\alpha_1<0$ in case (8), $e^{-(g-\alpha_1)T}-1>0$. Therefore,

(b) $\dot{m}>0$

and

(c) $\dot{m}\rightarrow 0 \quad (t\rightarrow\infty)$

because $e^{(g-\alpha)t} \to 0 \quad (t \to \infty)$.

This means m converges to a certain finite value. Let us get this value. Integrating (a), we have

$$\text{(d)} \quad \int \dot{m} dt = \frac{a_1}{a_2} \{e^{-(g-\alpha_1)T} - 1\} \int e^{(g-\alpha_1)t} \, dt + c$$

where

C is an unknown constant.

Solving (d),

$$\text{(e)} \quad m = \frac{a_1}{a_2} \cdot \frac{e^{-(g-\alpha_1)T} - 1}{g-\alpha_1} e^{(g-\alpha_1)t} + C$$

Let m_0 be an initial value. Then

$$\text{(f)} \quad C = m_0 + \frac{a_1}{a_2} \cdot \frac{1 - e^{-(g-\alpha_1)T}}{g-\alpha_1}$$

and we have

$$\text{(g)} \quad \lim_{t \to \infty} m = C = \frac{a_1}{a_2} \cdot \frac{1 - e^{-(g-\alpha_1)T}}{g-\alpha}$$

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RESEARCH INSTITUTE FOR ECONOMICS AND BUSINESS ADMINISTRATION, KOBE UNIVERSITY

HISTORICAL SKETCH

In 1919, a research organization named the Institute for Commerce was founded in Kobe Higher Commercial School, one of the chief predecessors of Kobe University, with a gift made by F. Kanematsu & Company, a leading mercantile firm in Kobe. The organization was designed to carry on and facilitate integrated research on business and commerce and to formulate and publish the results of these studies and investigations in such form as to make them available to the business community.

With the founding of Kobe University of Commerce, successor of Kobe Higher Commercial School, in 1929, the Institute extended its research activities by adding several divisions. One was the famous Latin-American Library, which soon became the center of research in this field in Japan. A room for statistics equipped with various computing machines was established and began publication of *Jūyō Tōkei Keizai* monthly and *Sekai Bōeki Tōkei* annually. A filing room was prepared to deposit press clipping files systematically arranged by topics and dates. Another room was designed to become the center of all possible original records and data having to do with the beginning and progress of Japanese business.

On the campus of Kobe University of Commerce, another organization named the Institute for Business Mechanization was founded in 1941 utilizing business machines donated by the IBM Corporation and others. With Professor Yasutaro Hirai as its head a broad and forward-looking plan for business mechanization in Japan was developed.

In 1944, Kobe University of Commerce changed its name to Kobe University of

Economics. After the War, however, the University was consolidated with three other colleges in Hyōgo Prefecture to become Kobe University. With this development, the two Institutes were also amalgamated into the Research Institute for Economics and Business Administration, Kobe University. At present, the Institute, with its twenty four full-time professional staff members, carries on studies and investigations in international economy, business administration, and information systems in Japan.

LOCATION AND BUILDINGS

The Research Institute for Economics and Business Administration is located on the campus of Kobe University, Rokko, Kobe. It consists of two three-storied buildings. One is named the Kanematsu Kinenkan and has a floor space of about 2,900 square meters, which includes a president's room, forty-one offices, six rooms used as a library, a room for statistics, etc. Another is built in 1964. It has a floor space of about 1,900 square meters, which is chiefly used as the Documentation Center for Business Analysis, a library and a conference room.

ORGANIZATION

Under the directorship of the president, the Institute operates with two research groups. Each research group and its sections are as follows:

A Group of International Economy

(1) International Trade
(2) International Finance
(3) Maritime Economy
(4) Latin-American Economy
(5) Oceanian Economy
(6) International Labour Relations

B Group of Business Administration

(1) International Management
(2) Business Administration and Information Systems
(3) Accounting
(4) Business Statistics

Besides the regular work of the Institute, research committees may be created to carry on any special work requiring the joint study of academic and business circles. At present, there are five standing research committees, as follows: Experts Group on the World Trade Structure, Committee of International Finance, Committee of Information Systems, Committee of Oceanian Economy and Committee of Maritime Labour.

For convenience and greater efficiency in carrying out its research activities, the Institute has a general office which is responsible for 1) the collection and preservation of a comprehensive collection of books, periodicals, pamphlets, and original records and data of finance, trade, commerce, industry and business generally; 2) the classification, cataloguing, indexing arranging, annotation and compilation of these research materials; and 3) the formulation and publication of the results of the investigations and studies accomplished by the professional staff members of the Institute.

As an affiliated institute, the Documentation Center for Business Analysis has been established in 1964. It is the first systematic information facilities in the field of business administration in Japan that has been recognized and authorized by the Ministry of Education. The purpose is to collect and to make intensive control of all kinds of materials on business administration and to make them available to scholars, universities, governments, and business world with the aid of modern documentation techniques.

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