THE INTERNATIONAL TRANSMISSION OF FISCAL POLICY ON WELFARE, INVESTMENT AND TRADE: AN INTERTEMPORAL APPROACH.

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Maggio 1985

N. 15

1. INTRODUCTION

The remarkable increase in the real rate of interest all over the world and the appreciation of the dollar real exchange rate, toghether with the large fiscal stimulus from President Reagan's program has brought government deficits and their effects on the economy back to the foreground of policy debate.

Two are the main strands of analysis one finds in the open-macroeconomics literature.

The first one, whose preminent examples are Branson-Buiter(1983), Sachs-Wyplosz(1984), in line with the Mundell-Fleming framework emphasizes the link between the real exchange rate and fiscal stimulus. By not taking an intertemporal optimizing approach these studies fail to properly investigate the determination of the real rate of interest, saving investment and trade balance, which by their nature are intertemporal issues.

The second strand focuses on the intertemporal aspects. The best known examples of this part of the literature, as far as the general equilibrium two country framework is concerned, are Buiter(1984), Giovannini(1984), on one hand and Frenkel-Razin(1984a) on the other. They differ from each other mainly for the finite versus infinite consumer's decision horizon; a problem which goes back to the debate on the relevance or irrelevance of the so called Ricardo equivalence theorem , most recently brought to the attention by Barro's influential paper(1974).

Buiter and Giovannini take the Yaari uncertain life time approach (1965)as applied to macroeconomics by Blanchard(1983). Because there is no bequest motive and agents face a probability of death, the consumer's decision horizon is essentially finite(1).

In Frenkel-Razin consumers are inifinitely lived as far as their saving decision is concerned, so that the Ricardo equivalence theorem does apply. Here the focus is on the dependence of the patterns

of consumption in one country on fiscal policy in the rest of the world. output is fixed because no investment is taking place and fully flexible wages are assumed at any period so to clear the labor market at full employment. A feature which is shared by all the above mentioned works.

This paper falls in the second strand of the literature. In line with Frenkel-Razin's work it takes the Barro's view of the world and it extends the analysis of how fiscal policy is internationally transmitted in two directions. It allows for capital formation, so to deal with crowding out issues and for labor market disequilibrium caused by Fischer(1977), Gray(1978) type contract wage-rigidity, so to capture both the intertemporal aspects and short run phenomena, such as the unemployment transmission of fiscal policy.
Throughout the whole analysis we shall deal with an intertemporal two goods, two country framework so to trace the international transmission of fiscal policy,as far as welfare, saving, investment and trade balance are concerned, through the simultaneous determination of the real exchange rate(home static terms of trade) and the various real ratesof interest(intertemporal terms of trade) which are relevant for investment and saving decisions at home and abroad.

The paper is organized as follows: Section two specifies the equilibrium of the world economy according to a two goods, per period, two country-two period full optimization set up(2), under the assumption of a fully integrated world capital market, full rationality of all economic agents, firms households and governments, whose decisions are subjected to intertemporal budget constraints. In section three, the international transmission of fiscal policy, both of permanent and temporary nature, as far as welfare, investment and trade balance are concerned, is discussed under the assumption that there is full employment. The implications of short run sticky wages

and variable employment on patterns of consumption and investment in the two countries are derived in section four. Section five draws some conclusions.

II The model

We consider a world of two countries, the home country (h) and the foreign country (f). There are two dates indexed t=1 and 2, which are called the present and the future.

Two goods are produced in both time periods: home goods, produced exclusively in the home country,and a foreign good, produced exclusively in the foreign country which is an imperfect substitute for home goods in consumption. Throughout the paper we shall use the foreign good as the numeraire.

Both countries can trade goods on the world market at each date, they also have access to a common world credit market, where home and foreign bonds are perfect substitutes. In the present, no country has inherited debt from the past.

The production side

Let's examine the behavior of the foreign country, modelling first its production side.

Production of goods, at each date t=1,2, is carried out by two factors of production, capital K^t and labor N^t, according to a well-behaved concave production function, $f(K_f^t, N_f^t)$. Initially , flexible wages ensure a given full employment level N at each date in both countries, the full employment assumption will be relaxed in section IV.

The capital stock in the first period is inherited by the past and it fully depreciates at the end of period. The second period capital stock K_f^2 is endogeneously determined by the investment decision made at t=1.

Let's denote the (foreign real)discount factor by δ, which is the present value of future goods in terms of currently-produced foreign goods. It is identical to $1/(1+r)$, where r is the (foreign goods) real rate of interest. The optimum level of investment will be such

to maximize the excess of the present value of future output over the cost of present investment, i.e., the solution to the problem, $\max \delta f(I_f,N)-I_f$.

The investment function will then fulfill the first order condition:

$$\delta f_K(N,I_f)=1 \qquad [1'a]$$

which says that firms invest up to the point where the present value of the future marginal product of capital, f_K, equals unity, the price of present investment goods; or also that investment is carried to the point where the net marginal product of capital equals the foreign goods own rate of interest, $f_K-1=r$.

Condition [1'a] implicitely defines the investment function, by totally differentiating it:

$$dI_f=a\,\hat{\delta} \qquad [1a]$$

with $a=\left|f_K/f_{K,K}\right|$. The $\hat{}$ over a variable denoting its percentage rate of change.

With symmetric assumptions on home country's technology, using foreign goods as the numeraire, home investment fulfills the first order condition:

$$\delta P^2 f_K(N,I_h)=P^1 \qquad [1'b]$$

where P^t is the price of home goods in terms of foreign goods. A positive change in P^t implying an improvement in the home terms of trade. We shall refer to P^t as the home static terms of trade.

Equation [1'b] says that firms in the home country invest up to the point where the return in period two to investing in home capital goods in period one, measured in foreign goods and including capital gains, equals the return to investing in foreign assets r,

$$\left[f_K(N,I_h)-1\right](P^2/P^1)+(P^2-P^1)/P^1=r$$

Differentiation of [1'b] shows that investment patterns cross-countries differ whenever the home static terms of trade differ through time periods:

$$dI_h=a\,\hat{\delta}_h=a(\hat{\delta}-\hat{P}^1+\hat{P}^2) \qquad [1b]$$

Households and the intertemporal budget constraint

Consumer preferences are represented by an intertemporal utility function defined over consumption of home and foreign goods at the two dates:

$$U=U\left[C_f^1(c_{f,f}^1 , c_{f,h}^1) , C_f^2(c_{f,f}^2 , c_{f,h}^2)\right]$$

where the first subscript refers to the country (foreign country), the second one refers to the market. So that $c_{f,f}$ is consumption of foreign country's residents of foreign output; $c_{f,h}$ is consumption of foreign country's residents of home country's output.

The utility function is written as weakly homotetically separable between the two dates, and the subutility functions C_f^t are linearly homogeneous of degree one in consumption of foreign goods $c_{f,f}^t$ and home goods $c_{f,h}^t$. Under these assumptions we can define for each sub-utility function C_f^t, $t=1,2$, a unity sub-utility expenditure function defined over the corresponding time period prices only (3):

$$\pi_f^t(P^t)C_f^t=\min(P^t c_{f,h}^t+c_{f,f}^t)\,\big|\, C_f^t(\cdot) \geq C_f^t$$

$\pi_f^1(\cdot),\pi_f^2(\cdot)$ define the minimum cost per unit of sub-utility C_f^1,C_f^2. The two price index functions are the same under the assumption $C_f^1(\cdot),C_f^2(\cdot)$ functions are the same, which we henceforth assume.

The expenditure function associated with the intertemporal utility function U, can then be written as:

$$E(\pi_f(P^1), \pi_f(P^2)\delta, u_f)= \min(\pi_f(P^1)C_f^1+\pi_f(P^2)\delta C_f^2)\,\big|\, U(\cdot)\geq u_f$$

By standard properties of the expenditure function:

$$C_f^1 =\partial E/\partial \pi_f(P^1)=C^1(R_f,u_f) \qquad [2a]$$

$$C_f^2 =\partial E/\partial \pi_f(P^2)=C^2(R_f,u_f) \qquad [3a]$$

$$c_{f,h}^t=\partial[\pi_f(P^t)C_f^t]/\partial P^t=c_{f,h}(P^t,C_f^t) \qquad [4a]$$

$$c_{f,f}^t=\pi_f(P^t)C_f^t-P^t c_{f,h}^t=c_{f,f}(P^t,C_f^t) \qquad [5a]$$

$R_f = \delta\Pi_f(P^2)/\Pi_f(P^1)$ is the intertemporal terms of trade for the foreign country.

By standard properties of the price index function, the elasticity of $\Pi_f(\cdot)$ relatively to P^t is equal to the share of home goods(imported goods by country f) in foreign consumption:

$$\varepsilon\Pi_f/\varepsilon P^t = 1-\alpha = P^t c^t_{f,h}/\Pi_f(P^t)C^t_f$$

The foreign intertemporal terms of trade, the real rate of interest and the home static terms of trade will then be related as follows:

$$\hat{R}_f = \hat{\delta} + (1-\alpha)(\hat{P}^2 - \hat{P}^1) \qquad [6a]$$

The foreign country's intertemporal budget constraint can be expressed as:

$$E(1,R_f,u_f) = W_f = y^1_f - \left[1/\Pi_f(P^1)\right](I_f + g^1_{f,f} + P^1 g^1_{f,h}) + R_f\left\{y^2_f - \left[1/\Pi_f(P^2)\right](g^2_{f,f} + P^2 g^2_{f,h})\right\} \qquad [7a]$$

where $y^t_f = f(N,K^t_f)/\Pi_f(P^t)$, with $K^2_f = I_f$, is foreign real income as measured in units of sub-utility at dat t.

$g^t_{f,i}$, i=h,f, denote the foreign government sector demands for home and foreign goods.

The budget constraint states that the present value of expenditure on consumption equals the present value of output, in the present and in the future, net of investment and lump sum taxes levyed by the government over the two periods. It is consistent with the hypothesis that every sector in the economy, households, firms and government are zero saver over their life time span.

With symmetric assumptions for the home country, real consumption of the home household's sector at the two dates (C^1_h, C^2_h) and home residents demand for home and foreign goods $(c_{h,h}, c_{h,f})$ at period t are:

$$C^1_h = C^1(R_h, u_h) \qquad [2b]$$

$$C^2_h = C^2(R_h, u_h) \qquad [3b]$$

$$c^t_{h,h} = c_{h,h}(P^t, C^t_h) \qquad [4b]$$

$$c^t_{h,f}=c_{h,f}(P^t, C^t_h) \qquad [5b]$$

The elasticity of the home price index $\Pi_h(\cdot)$ relatively to the static home terms of trade P^t is equal to the share of home goods in home consumption:

$$\varepsilon\Pi_h/\varepsilon P^t=\alpha=(P^t c^t_{h,h})/(\Pi_h(P^t)C^t_h)$$

The home intertemporal terms of trade:

$$R_f=\delta\Pi_h(P^2)/\Pi_h(P^1)$$

is then related to the foreign intertemporal terms of trade and the home static terms of trade in the following manner:

$$\hat{R}_h=\hat{\delta}+\alpha(\hat{P}^2-\hat{P}^1)=\hat{R}_f+L(\hat{P}^2-\hat{P}^1) \qquad [6b]$$

$L=\alpha-(1-\alpha)$, the difference between the share of expenditure of each country in its own goods (α) and the share of expenditure in imported goods ($1-\alpha$), defines the degree of asymmetry in cross-country spending pattern by households. A positive value of L implying a larger proportion of expenditure of each country in its own products than in foreign goods.

The home country intertemporal budget constraint is:

$$E(1,R_h,u_h)=W_h=y^1_h-(1/\Pi_h(P^1))(P^1(I_h+g^1_{h,h})+g^1_{h,f})+R_h\{y^2_h-(1/\Pi_h(P^2))\cdot(P^2 g^2_{h,h}+g^2_{h,f})\} \qquad [7b]$$

where $y^t_h=(P^t/\Pi_h(P^t))f(N,K^t_h)$, with $K^2_h=I_h$, is home real income as measured in units of sub-utility at date t.

$g^t_{h,i}$, i=h,f, denotes the home government sector demand for home and foreign goods.

World Equilibrium

There are four economy-wide equilibrium conditions, market clearing for home and foreign goods in period one and two. Because of

Walras'law we shall explicetely consider three of them, that is the two first period goods market clearing conditions and the market clearing for home goods in period two:

$$c^1_{f,f}+c^1_{h,f}+g^1_{f,f}+g^1_{h,f}=f(N,K^1)-I_f \qquad [8]$$

$$c^1_{h,h}+c^1_{f,h}+g^1_{h,h}+g^1_{f,h}=f(N,K^1)-I_h \qquad [9] \qquad (I)$$

$$c^2_{h,h}+c^2_{f,h}+g^2_{h,h}+g^2_{f,h}=f(N,I_h) \qquad [10]$$

Combining [8] and [9], gives after some simple manipulations (4), as equivalent relation, the equilibrium condition in the world capital market:

$$\left\{\left[P^1 f(N,K^1)-\tau^1_h-\Pi_h(P^1)C^1_h\right]-P^1 I_h\right\}+\left\{\left[f(N,K^1)-\tau^1_f-\Pi_f(P^1)C^1_f\right]-I_f\right\}=$$

$$(g^1_{h,f}+P^1 g^1_{h,h}-\tau^1_h)+(g^1_{f,f}+P^1 g^1_{f,h}-\tau^1_f) \qquad [11]$$

with τ^1_i, i=h,f, lump sum taxes levyed by the government in the current period.

The terms in square brackets on the left hand side of [11] define the home and foreign private sector's saving, on the right hand side the home and foreign government sector's deficits, at date one. Equation [11] is thus stating that world private saving net of investment is equal to world's public sector's dissaving, or alternatively, world demand for bonds equals supply.

Recalling the definition of real income, y_h, y_f, equation [11], after simple manipulations, gives the equivalent relation:

$$t^1_h=-\Pi(P^1)t^1_f \qquad [11a]$$

with $\Pi(P^1)=\Pi_f(P^1)/\Pi_h(P^1)$

t^1_f is the foreign real trade balance, at t=1,

$$t^1_f=y^1_f-C^1_f-(1/\Pi_f(P^1))(I_f+g^1_{f,f}+P^1 g^1_{f,h}) \qquad [12a]$$

t_h^1 is the home real trade balance, at date one,

$$t_h^1=y_h^1-C_h^1-(1/\Pi_h(P^1))(P^1(I_h+g_{h,h}^1)+g_{h,f}^1) \qquad [12b]$$

The intertemporal budget constraints, [7a], [7b] , imply:

$$t_f^1+R_f t_f^2=0$$

$$t_h^1+R_h t_h^2=0$$

trade is balanced in present value terms over the two periods. The relationship expressed by [11a] will then also hold in the second period:

$$t_h^2= -\Pi(P^2)t_f^2$$

System (I) can be solved in terms of the home static terms of trade at the two dates, P^1, P^2, and the real discount factor δ. The effects on welfare, trade balance and investment of different time and cross-country patterns of fiscal policy will then traced back to the shift in the real price vector solution.

By differentiation of [7a], [7b], making repeated use of the properties of the expenditure functions, we can explain the countries' welfare's change as the result of the movement in the home static terms of trade and in lump sum taxes needed to balance the government budget over the two periods:

$$E_u du_f=-T\hat{P}^1-\delta T\hat{P}^2- dg_f^1-\delta dg_f^2 \qquad [13a]$$

$$E_u du_h= T\hat{P}^1+\delta T\hat{P}^2- dg_h^1- \delta dg_h^2 \qquad [13b]$$

The above expressions have been derived by assuming as initial position the stationary state, where the export-import vectors are equal cross-countries and time periods, and the home static terms of trade is unity at both dates.

$T=c_{f,h}^t+g_{f,h}^t=c_{h,f}^t+g_{h,f}^t$ defines, in absolute value, the real static terms of trade effect connected with a positive change in P.

$$dg^t_f = dg^t_{f,f} + dg^t_{f,h}$$
$$dg^t_h = dg^t_{h,h} + dg^t_{h,f}$$

to simplify notation we will define, for future refernce,

$$dg^t_{f,f} = \beta dg^t_f \ , \ dg^t_{f,h} = (1-\beta) dg^t_f$$
$$dg^t_{h,h} = \beta dg^t_h \ , \ dg^t_{h,f} = (1-\beta) dg^t_h$$

where $(1-\beta)$ can be interpreted as the public sector's import propensity.

The change in the trade balance surplus is the result of two basic factors. The consumption smoothing of the welfare gains (or losses) due to changes in lump sum taxes and in the home static terms of trade at the two dates, the intertemporal terms of trade effect on saving and investment decisions.

$$dt^1_h = -dt^1_f = (\hat{P}^1 - \hat{P}^2)(\delta C_w T + C_R \delta \alpha + a) - (C_R \delta + a)\hat{\delta} - \delta C_w (dg^1_h - dg^2_h) \qquad [14]$$

with: $C_w = C^t_{h,w_h} = C^t_{f,w_f} = (\partial C^t / \partial u)/(\partial E/\partial u)$ (5)

$$C_R = C^1_{h,R_h} = C^1_{f,R_f} = (\partial C^1/\partial R) > 0$$

Totally differentiating system (I) and making use of [13a] -[13b] , we can get the change in the home static terms of trade, at the two dates, as the solution of the following:

$$a_{11}\hat{P}^1 + a_{12}\hat{P}^2 = S^1 \qquad [15]$$
$$a_{21}\hat{P}^1 + a_{22}\hat{P}^2 = S^2 \qquad [16] \qquad (I')$$

the change in the foreign real discount factor, δ, is given by:

$$\hat{\delta} = \left[1/(C_R\delta + a)\right](S^1_f + m_1\hat{P}^1 + m_2\hat{P}^2) \qquad [17]$$

where:

$$S^1_f = -dg^1_f(\beta - \alpha C_w) - dg^1_h\{(1-\beta) - (1-\alpha)C_w\} + \delta dg^2_f \alpha C_w + \delta dg^2_h (1-\alpha) C_w$$
$$S^1 = (dg^1_f - dg^1_h)\{\beta - (1-\beta) - C_w L\} - \delta C_w L (dg^2_f - dg^2_h)$$
$$S^2 = (dg^2_f - dg^2_h)\{\beta - (1-\alpha) - C_w \delta L\} - \{(1/\delta)(\beta - \alpha) + C_w L\}(dg^1_f - dg^1_h)$$
$$m_1 = -\eta + C_w TL + 2\alpha(1-\alpha) C_R \delta \ ; \ m_2 = \delta m_1 + \delta\left[\eta - 2\alpha(1-\alpha) C_R (1/C_w)\right]$$

$a_{11}=-2\eta+2C_w TL-C_R\delta L^2-a$; $a_{12}=-\delta a_{22}-\delta(\eta-TL)$; $a_{21}=-(1/\delta)\left[a_{11}+(\eta-TL)\right]$

$a_{22}=-\eta+(1-1/\delta)C_w\delta TL-C_R L^2-a(1/\delta)$

with, $\eta=(\partial c_{h,f}/\partial P)+(\partial c_{f,f}/\partial P)=-(\partial c_{h,h}/\partial P)+(\partial c_{f,h}/\partial p)>0$

Having assumed a unit value of the home static terms of trade, P^t, at both dates, as the initial position of stationary state, α defines at the same time the propensity to consume out of consumption expenditure, C^t, by home (foreign) residents on home (foreign) goods; $(1-\alpha)$ is the import propensity.

The determinant of system (I') is positive, thus implying Walrasian price-tatônnement stability, for an elasticity of substitution between home and foreign goods such that $\eta>TL$, which we henceforth assume.

III The international transmission of fiscal policy

We are now ready to discuss the international transmission of fiscal policy and prove the following propositions:

1) Home static terms of trade induced effects of fiscal policy abroad and cross countries differences in intertemporal prices depend upon the degree of asymmetry in cross-countries patterns of consumption and public sector expenditure's.

2) With fully flexible wages, investment, saving and trade balance at home and abroad only depend upon the time patterns of fiscal policy.

Propositions one and two, as far as the case of perfect symmetry in cross-countries patterns of consumption and public sector expenditure's are concerned, immediately follow by looking at the terms S^1, S^2 in the right hand side of equations [15], [16] and by recalling the expression for the foreign real discount factor [17].

S^t, $t=1,2$, measure the excess supply in the home goods market at the two dates, induced by different government's expenditure in the two countries, $dg_f^t=dg_h^t$.

The excess supply is the result of two separate effects. The direct effect induced by the public sector's demand for goods. The indirect effect on hosehold's consumption expenditure caused by the increase in lump-sum taxes levyed by the government, over the two periods, so to satisfy the intertemporal budget constraint.

Fiscal policy is not transmitted internationally, $S^t=0$, only if there is perfect symmetry in cross-countries patterns of private and public expenditures:

$\beta^* = 1-\beta$

$L=\alpha-(1-\alpha)=0$

that is if, for both countries and sectors, the propensity to spend on home, its own, goods equals the import propensity, $\beta^* = 1-\beta=\alpha=1-\alpha$.

In this particular case there will be no change in the home static terms of trade, $\hat{P}^t=0$, and therefore the burden of fiscal policy abroad will only be borne by the foreign country:

$E_u du_f=-dg_f^1- dg_f^2$

$E_u du_h=0$

Intertemporal prices, induced effects of fiscal policy, won't differ cross countries:

$\hat{\delta}_h = \hat{\delta}-\hat{P}^1+\hat{P}^2=\hat{\delta}$

$\hat{R}_h=\hat{R}_f+L(\hat{P}^2-\hat{P}^1)=\hat{R}_f$

$\hat{R}_f=\hat{\delta}+(1-\alpha)(\hat{P}^2-\hat{P}^1)=\hat{\delta}$

The real discount factor, and therefore saving investment and trade balance, will be affected by fiscal policy only in so far the change in government expenditure differs through time periods:

$\hat{\delta}=\left[1/(C_R\delta+a)\right] S_f^1$

for $\beta^* = 1-\beta=\alpha=1-\alpha=\frac{1}{2}$

$S_f^1=-\frac{1}{2}\delta C_w\left\{(dg_f^1+dg_h^1)-(dg_f^2+dg_h^2)\right\}$

We can immediately see that in this case, an exactly offsetting measure of a temporary change in foreign fiscal policy by the home government will leave the real rate of interest unaltered. Which is what we would expect given that all goods can be aggregated into a single composite commodity so that the world economy's model reduces to one good, per period, one asset model.

If such condition doesn't hold, as we shall see in the next two sections, fiscal policy will be transmitted internationally.

The transmission, as far as welfare's effects are concerned, will be negative whenever the public sector's import propensity falls short of the private sector's import propensity:

$1-\beta < 1-\alpha$

The world welfare loss associated with the increase in taxes levyed by the foreign government to finance its expenditure's increase:

$E_u du_f + E_u du_h = -dg_f^1 - \delta dg_f^2$

will be shared between the two countries.

Home welfare does in fact unambiguously worsen, $E_u du_h < 0$, for both permanent and transitory increase in foreign government expenditure.

The propensity to spend on home goods, its own goods, differing from the import propensity:

$L \neq 0, \alpha \neq 1-\alpha$, and $1-\beta \neq 1-\alpha$

being simultaneously satisfied, will be a sufficient condition for the movement in the home static terms of trade, due to temporary fiscal policy, differing through time periods and therefore for intertemporal prices, saving and investment, differing among countries.

Permanent increase in foreign government expenditure.

$dg_f^1 = dg_f^2 = dg_f > 0 \quad ; \quad S^1 = 2(\beta-\alpha)dg_f \; ; \quad S^2 = (1-1/\delta)(\beta-\alpha)dg_f$

For $\beta > \alpha$ the home static terms of trade and the home country's welfare unambiguously worsen:

$$\hat{P}^1 = \hat{P}^2 = \hat{P} = -\{(\beta - \alpha) m_3\} dg_f < 0$$

$$E_u du_h = T(1+\delta)\hat{P} < 0$$

with, $m_3 = \eta - TL > 0$

The expanding country, in our case the foreign country, is not necessarily worse-off:

$$E_u du_f = -dg_f(1+\delta) - T(1+\delta)\hat{P} = -(1+\delta) dg_f \{1 - (\beta - \alpha) T/m_3\}$$

$E_u du_f < 0$ if:

$$\eta > T(L + \beta - \alpha) \qquad [18]$$

the condition being more stringent than the one required for price tatônnement stability.

A permanent change in government expenditure unambiguously leaves the intertemporal prices unaltered. In expression [17]:

$$m_1 + m_2 = -m_3$$

and, given the permanent nature of the increase in g_f:

$$S_f^1 = -(\beta - \alpha) dg_f$$

therefore:

$$\hat{\delta} = 0 \; ; \quad \hat{\delta}_h = \hat{\delta} + \hat{P}^2 - \hat{P}^1 = 0 ; \quad \hat{R}_f = \hat{R}_h = 0$$

Because the change in the home static terms of trade is constant through time periods, the consumption smoothing of the welfare change with it associated, implies no change in saving.

Home saving is therefore unaffected, foreign private sector's saving changes only in so far it reflects the consumption smoothing of taxes levyed by the government over the two periods. Foreign private sector saving in the current period, no matter the timing of taxation, will increase as much as the public sector dissaves.

Recalling that both home and foreign investment depend upon the real rate of interest and differ from each other only in so far the movement in the static terms of trade differ through time periods,

the equivalence between private saving and government's dissaving in the foreign country will imply, in terms of equation [11], world capital market clearing at an unchanged level of the real rate of interest.

Investment at home and abroad will be unaffected:

$$dI_f = a\hat{\delta} = 0; \quad dI_h = a(\hat{\delta} - \hat{P}^1 + \hat{P}^2) = 0$$

A permanent increase in government expenditure is therefore entirely financed through the fall in world consumption. That is through the fall in home consumption and in the foreign (expanding) country's consumption, whenever condition [18] is satisfied.

From expression [14], recalling that $\hat{P}^1 - \hat{P}^2 = \hat{\delta} = 0$, we see that the home, and therefore, the foreign, trade balance is unaffected:

$$dt_h^1 = -dt_f^1 = 0$$

Which is of course what we would expect given the invariance of home and foreign investment and the fact that home saving doesn't change, wherease foreign private saving exactly matches government dissaving.

Temporary (current) increase in foreign government expenditure

$$dg_f^2 = 0 \; ; \; dg_f^1 > 0 \quad (6)$$

$$S^1 = \left\{\delta C_w L + 2(\beta - \alpha)\right\} dg_f^1 \; ; \; S^2 = -\left\{C_w L + (\beta - \alpha)(1/\delta)\right\} dg_f^1$$

if $\beta > \alpha$ and the consumer's propensity to spend on home goods, its own goods, exceeds the import propensity, which is also the foreign propensity to import, $L > 0$, that is if the condition of a transfer of goods leading to higher welfare for the recipient country is satisfied(7):

$$S^1 > 0, \; S^2 < 0$$

In the home goods market, at the initial level of the home static terms of trade, there will be a positive excess supply in the current period and a positive excess demand in the second period. The main reasons behind these effects are the following. In the cu-

rrent period, the composition of world demand switches from the home market to foreign goods market as a result of the increase in foreign government expenditure. Given that the proportion falling in the foreign market does exceed the decrease in foreign consumption of foreign goods induced by higher taxation.

In the second period the reverse is true. Because government expenditure is constant and foreign consumption decreases, with $\alpha > 1-\alpha$, the composition of world demand switches from the foreign to the home goods market.

The home static terms of trade unambiguously worsen in the current period, wherease they might appreciate in the second period:

$$\hat{P}^1 = -\left[C_w L\delta m_3 + (\beta-\alpha)m_4\right](1/D)dg_f^1 < 0$$

$$\hat{P}^2 = \left[C_w L m_3 - (\beta-\alpha)m_5\right](1/D)\, dg_f^1 \gtrless 0$$

being: $m_4 = 2(m_3 + TLC_w) + C_R L^2 + a/\delta > 0$

$$D = m_3\left\{2\eta + C_R L^2(1+\delta) + a\left[(1+\delta)/\delta\right]\right\} > 0$$

$$m_5 = 2C_w TL + C_R L^2 + a(1/\delta) > 0$$

With $\beta > \alpha$, home welfare unambiguously worsens:

$$E_u du_h = -\left\{T(\beta-\alpha)/m_3\right\} dg_f^1 < 0$$

As in the previous case, the expanding country's welfare:

$$E_u du_f = -\left\{1-(\beta-\alpha)T/m_3\right\} dg_f^1$$

deteriorates only in so far condition [18] is satisfied.

$\beta > \alpha$ and $L > 0$, simultaneously holding, is a sufficient condition for a transitory current increase in government expenditure causing, for the expanding(foreign) country, an increase in the real rates of interest, that is a fall in the intertemporal terms of trade and in the real discount factor:

$$\hat{R}_f = -\left\{m_3/D(C_R\delta + a)\right\} m_6 dg_f^1 < 0$$

$$\hat{\delta} = -\left\{m_3/D(C_R\delta + a)\right\} m_7 dg_f^1 < 0$$

where: $m_6 = \{\eta\delta C_w + C_R\delta L^2 + a(\alpha - (1-\alpha)L) + (\beta-\alpha)L(C_R\delta + a)\}$

$m_7 = \eta\delta C_w + C_R\delta(\alpha L + \beta - \alpha) + a\beta$

are both positive for $\beta > \alpha$, $L > 0$.

The disturbance does, therefore, crowd-out foreign investment, $dI_f = a\hat{\delta}$, and lead a substitution effect towards future consumption.

Restriction [18] being satisfied is a sufficient condition for current real consumption decreasing:

$dC_f^1 = C_R\delta\hat{R}_f + C_w E_u du_f < 0$

The real rates of interest for the non expanding (home) country, will be lower than for the foreign country:

$\hat{\delta}_h - \hat{\delta} = \hat{P}^2 - \hat{P}^1 > 0$

$\hat{R}_h - \hat{R}_f = L(\hat{P}^2 - \hat{P}^1) > 0$

being:

$\hat{P}^2 - \hat{P}^1 = (m_3/D)\{L + 2(\beta-\alpha)\} dg_f^1$

positive for $L > 0$, $\beta > \alpha$.

Crowding out of investment at home will thus be lower than abroad. Opposite conclusion will of course hold if $L < 0, \beta < \alpha$, that is if a current temporary increase in foreign government expenditure leads a revaluation of the current home static terms of trade.

With consumption smoothing of the welfare loss and intertemporal substitution effects working in opposite directions, the induced effect on the home (foreign) trade balance is not clear cut:

$dt_h^1 = -dt_f^1 = (\hat{P}^1 - \hat{P}^2)(\delta C_w T + C_R\delta\alpha + a) - (C_R\delta + a)\hat{\delta}$

where: $\hat{P}^1 - \hat{P}^2 < 0$ and $\hat{\delta} < 0$, for $\beta > \alpha$, $L > 0$

$\hat{P}^1 - \hat{P}^2 > 0$ for $\beta < \alpha$, $L < 0$

In explicit form:

$dt_h^1 = -dt_f^1 = (m_3/D)\{m_3\delta C_w + a(1-\alpha) - (\beta-\alpha)m_8\} dg_f^1$

with, $m_8 = 2\delta C_w T + C_R \delta L + a$, certainly positive for $L > 0$.

A sufficient condition for the foreign (expanding) country's trade balance deteriorating is $\beta = \alpha$. The case where fiscal policy abroad leaves home welfare unaltered and fiscal expansion is financed through the cut in world investment and real consumption, over the two periods, only as far as the expanding country is concerned.

IV Short run sticky wages

From the previous discassion we have learned that, under fearly general conditions, fiscal policy is likely to be negatively transmitted internationally as far welfare effects are concerned. Fiscal expansion is responsible for the increase in the various real rates of interest only in so far it's not,rationally, expected to be mantained in the future. Furthermore crowding-out of investment, if any, will be larger in the foreign expanding country than at home.

Those conclusions match the facts as far as the static terms of trade movement is concerned, but do not seem to be compatible with the asymmetry in investment behavior in the United States and Europe, which, as observed in reality, runs the other way around.

We will now explore whether this can be explained by relaxing the assumption of perfectly flexible wages, which so far considered underlines labor market clearing at full employment both in the short and the long run, so to deal with the situation where in the short run there are rigid wages and variable employment.

Let's assume the final good wage, ω , in both countries, is sticky in the short run:

$$\omega_f^1 = w_f^1/\pi_f(P^1) = \bar{\omega}^1 \qquad [19'a]$$

$$\omega_h^1 = w_h^1/\pi_h(P^1) = \bar{\omega}^1 \qquad [19'b]$$

where w_i^1, i=f,h, is the wage rate expressed in terms of foreign goods, the numeraire.

The assumption being compatible with a situation, where at the beginning of the period wage contracts, are concluded using all information available at that time, in such a way that labor and goods market will clear if no shocks will occur during the period that are unanticipated at contract time.

Under assumptions [19'a] , [19'b] the product wage for the foreign and home country are respectevely:

$$w_f^1 = \bar{\omega}^1 \pi_f(P^1) \qquad [19a]$$

$$w_h^1 = \bar{\omega}^1 \pi_h(P^1)/P^1 \qquad [19b]$$

Employment abroad and at home will vary in response to unanticipated disturbances, that is as far as is kept fixed, whenever they affect the home static terms of trade:

$$dN_f^1 = -\gamma(1-\alpha)\hat{P}^1 \qquad [20a]$$

$$dN_h^1 = \gamma(1-\alpha)\hat{P}^1 \qquad [20b]$$

where $\gamma = |f_N/f_{N,N}|$; $f_N, f_{N,N}$ being respectevely the first and second derivative of the production function relatively to employment.

The endogeneous changes in employment will have separate effects on welfare and trade balance:

$$\tilde{E}_u du_f = E_u du_f + \bar{\omega}^1 dN_f^1 \qquad [21a]$$

$$\tilde{E}_u du_h = E_u du_h + \bar{\omega}^1 dN_h^1 \qquad [21b]$$

$$\tilde{dt}_h^1 = -\tilde{dt}_f^1 = dt_h^1 + (1-C_w)\bar{\omega}^{-1} dN_h^1 \qquad [22]$$

where $E_u du_f$, $E_u du_h$ and dt_h^1 are given by [13a] , [13b] and [14] respectevely.

Hence the effect of changes in the level of employment equals the change in real income. The induced effect on trade balance reflects the consumption smoothing of the welfare gain due to temporary current increase in real income.

To trace how fiscal policy affects world equilibrium in case of short run sticky wages, we must take into account consumer's decisions being affected by [21a] , [21b] and the fact that in equations [8] , [9] , the first period goods market clearing conditions, employment vary according to [20a], [20b] .

In system (I') a_{11}, a_{21} will be redifined as:

$$\tilde{a}_{11}=a_{11}-2\bar{\omega}^{-1}\gamma(1-\alpha)(1-C_w L)$$

$$\tilde{a}_{21}=a_{21}+\bar{\omega}^{-1}\gamma(1-\alpha)(1/\delta)\left[1-C_w L(1-\delta)\right]$$

in [17] , the expression for the foreign real discount factor:

$$\tilde{m}_1=m_1-\bar{\omega}^{-1}\gamma(1-\alpha)(1-C_w L)$$

where $\bar{\omega}^{-1}=w_f^1=(w_h^1/P^1)=f_N$, having assumed an initial unit value of the home static terms of trade.

The change in the current home static terms of trade is proportional to the one obtained for the flexible wage regime:

$$\tilde{\hat{P}}^1=\hat{P}^1\left\{D/(D+F)\right\}$$

with $F=\bar{\omega}^{-1}\gamma(1-\alpha)\left\{2\left[\eta(1-C_w L)-TL\delta C_w\right]+C_R L^2(1-L)+a(1/\delta)(1-L)\right\}>0$

$\beta>\alpha$, $L>0$, simultaneously holding is therefore a sufficient condition for fiscal expansion abroad, both of temporary nature, exporting unemployment in the home country. The home welfare loss will thus be exacerbated through the output fall.

The redistribution of unemployment from the foreign expanding country towards the home country will have separate effects on the intertemporal terms of trade.

The implication being that a permanent change in government expenditure, no more, leaves the intertemporal terms of trade unaltered.

For $dg_f^1 = dg_f^2 = dg_f > 0$, with $\beta > \alpha$, $L > 0$:

$$\hat{\tilde{R}}_f = \left\{(\beta-\alpha)\bar{\omega}^{-1}\gamma(1-\alpha)L/(D+F)\right\} dg_f > 0$$

$$\hat{\tilde{\delta}} = \left\{(\beta-\alpha)\bar{\omega}^{-1}\gamma(1-\alpha)/(D+F)\right\} dg_f > 0$$

$$\hat{\tilde{\delta}}_h = -\hat{\tilde{\delta}} < 0$$

$$\hat{\tilde{R}}_h = -\hat{\tilde{R}}_f < 0$$

With short run sticky wages, a permanent fiscal expansion, by the foreign country, which shifts unemployment in the home country, will unambiguously lower the real rates of interest, relevant for saving and investment decisions, in the foreign country and increase them for the home country. It will thus crowd-out investment at home and crowd-in it in the foreign expanding country. As a result the trade balance will now be affected. With foreign investment raising and the saving propensity falling, because R_f rises, the disturbance is likely to induce a trade balance deterioration for the foreign expanding country.

By the same reasoning, the real interest rate differential induced by a transitory, current, increase in foreign government expenditure ($\hat{\tilde{\delta}}_h - \hat{\tilde{\delta}}$) will shrink relatively to the case of full employment labor market clearing ($\hat{\delta}_h - \hat{\delta}$):

$$\hat{\tilde{\delta}}_h - \hat{\tilde{\delta}} = (\hat{\delta}_h - \hat{\delta}) - \left[1/(D+F)\right]\left[(m_3/D)\right] m_9 dg_f^1$$

where, $m_9 = 2\left\{\bar{\omega}^{-1}\gamma(1-\alpha)\right\}\left\{(\beta-\alpha)\left[C_R L^2 + (a/\delta) + 2(\eta - TL\delta C_w)\right] + L\delta C_w m_3\right\} > 0$

Thus leading an investment fall, in the home country, larger than the one derived for the fully flexible wage regime, the opposite holding for the foreign country.

V. Conclusion

In this paper we attemped to analyse the relation between government spending, real exchange rate and the intertemporal terms of trade as well as the international transmission of fiscal policy. Specifically we examined the dependence of investment, consumption patterns and welfare in one country on fiscal policy in the rest of the world. The welfare effects being the result of both home static terms of trade and employment induced changes of fiscal policy. The main conclusions can be schematically summarized as follows:

1)Home welfare induced effects of fiscal policy abroad and differences in intertemporal prices among countries,depend upon the asymmetry in household's and government's spending patterns at home relative to those abroad.

2)If wages are fully flexible, intertemporal prices and therefore saving investment and trade balance, will be affected only in so far the fiscal stimulus is of temporary nature. With short run sticky wages, provided spending patterns are not symmetric, both temporary and permanent fiscal expansion will affect the various intertemporal terms of trade and therefore saving and investment at home and abroad.

More precisely,if the condition of a transfer of goods leading to higher welfare for the recipient country is satisfied, that is if home consumers and home government spend more on home goods than foreigners, fiscal policy abroad will be financed by levying taxes on the home country through the appreciation of the expanding country's real exchange rate and by exporting unemployment whenever the wage rate is sticky in the short run. If the expansion is permanent the real exchange rate appreciation will be permanent. If it has temporary nature, the appreciation can be followed by a depreciation,

nevertheless the home country's welfare unambiguously worsens.

The international transmission of fiscal policy as far as investment in capital goods is concerned, strictly depends, other than the above mentioned condition, upon the wage rate regime. With fully flexible wages home investment will be crowded out by fiscal expansion to the extent it is not (rationally) expected to remain in the future. With sticky wages a fiscal expansion abroad, whether permanent or not, does crowd out investment in the home country, wherease it crowds in investment in the foreign country whenever it is (rationally) expected to remain in the future.

Labor market disequilibrium thus allows for, at least, a partial explanation of the different performances of employment and investment among non expanding and expanding countries as it has been observed in reality.

Footnotes

(1)On the same line is the paper by Frenkel-Razin(1984b).

(2)The two period optimization set up is by now a familiar tool for the analysis of the balance of trade as far as the small open economy is concerned. Preminent examples are Svensson-Razin(1983) and Sachs(1981). Chiesa(1984) provides an extension to the intermediate economy, which is price-maker of its own output, to analyse the oil shock's induced effects on employment, saving and investment. Extensions to fiscal policy analysis are van Wijnbergen (1984a,b). van Wijnbergen (1984a) analyses fiscal policy in one country framework, where the real rate of interest is exogeneously given by the world capital market. In van Wijnbergen(1984b) output is exogeneously given at full employment, there is no capital investment, the fiscal measure which is analysed is a commodity tax-cut.

(3)See Gorman(1975), Blackorby-Primont-Russell(1978), Diewert(1974) on separability and price indices.

(4)In deriving equation [11] we made use of the definition of the consumption expenditure: $c^1_{f,f}+P^1c^1_{f,h}=\Pi_f(P^1)C^1_f$; $c^1_{h,f}+P^1c^1_{h,h}=\Pi_h(P^1)C^1_h$.

(5)The budget constraint will imply $C^1_w(1+\delta)=1$.

(6)The opposite case of an increase in foreign government expenditure taking place in the second period will produce symmetric results. The international transmission of fiscal policy will be exactly the same as the one here considered, as far as welfare's effects are concerned. Of course the signs of changes in intertemporal prices and the time pattern of the static terms

of trade movement will be reversed.

(7)This condition is familiar from the theory of international economic transfers, full reference is given in Norman-Dixit (1980), ch.5.

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