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ON FISCAL DEFICITS, THE REAL EXCHANGE RATE AND THE WORLD RATE OF INTEREST

by

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Abstract :

We use a full general equilibrium 2-country, 2-period model with perfect capital markets, and intertemporal optimization and perfect foresight underlying private consumer behaviour in both countries to analyse effects of pure fiscal policy. We demonstrate that higher government budget deficits in one country caused by a cut in commodity taxes today balanced by an equal present value increase tomorrow, will not be offset one for one by higher private savings, because of pure substitution effects triggered by the change in the intertemporal terms of trade the tax change causes. The country with the increased government deficit will therefore run a larger current account deficit which in turn unambiguously leads to higher world real interest rates. Whether a real appreciation results in the country with the higher deficit is shown to depend on the Metzler condition for an undereffected transfer : if "we" spend more on our goods than "they" spend on our goods (on the margin), government deficits will lead to an appreciation of the exchange rate of the country with the government deficit and *vice versa*. We discuss the Bergsten proposal for what amounts to a tax on foreign borrowing and show it to be a beggar-thy-neighbour policy similar to optimal tariff arguments from trade theory.

1. Introduction

Since 1980, the exchange value of the dollar has increased nearly 50 per cent relative to the other major currencies after correcting for inflation differentials. Nominal interest rates have not come down in line with the substantial decline in inflation achieved over the period, resulting in sizeable increases in real interest rates. Over the same period national savings in the US fell from 7 to 1.5% in 1983 with current account deficits starting to increase. The decline in national savings is due to the fact that private savers in the US have not offset the substantial increases in government dissaving.

Simultaneously the government has been running increasingly large budget deficits up from 1% of GNP on average in the years preceding 1980 to 5.5% in 1983, with widespread agreement that this trend, at present policies, will not be reversed until the next decade, if at all.

There is by now probably an emerging consensus that these deficits are the major driving force behind the high real interest rates in the US and abroad, the high value of the dollar and the decline in private savings in the US documented in the opening paragraph (for a particularly persuasive presentation of that point of view see Feldstein (1983), from whom the figures mentioned above were taken).

If one consults the International Economics literature for support of this causal link between government deficits on the one hand and real appreciation, high interest rates and CA deficits on the other, one does not find much. Most work (see Branson and Buiter (1983) or Sachs and Wyplosz (1983) for the most comprehensive examples) is not really satisfactory for our purpose because set in an essentially static framework: consumers, although endowed with perfect foresight in modern contributions, only take into account current disposable income when determining their savings rate. This is somewhat unsatisfactory since savings, the CA and the real rate of interest (determining the rate at which goods today can be exchanged for goods tomorrow) are by their very nature intertemporal issues. The one paper that does take an intertemporal optimizing approach in fact contradicts the prediction of a real appreciation (Obstfeld (1983)). The partial equilibrium, one-country framework chosen there does not allow discussion of the real interest rate (under the assumption of perfect capital mobility made). Moreover we will argue below that general equilibrium effects are crucial in determining what the effect of government deficits on the real exchange rate are.

Barro (1974), in an influential paper set up in a closed economy context, has argued forcefully that taking an explicit intertemporal approach is essential for the analysis of fiscal policy changes. In fact he demonstrates that a change in financing mix resulting in higher current deficits for given public expenditure pattern (less taxes and more bonds today and the reverse tomorrow) will not affect private expenditure under assumptions including perfect capital markets, operative bequest motives and non-distortionary taxes. That would, in an open economy, imply : no effects on the CA, the world rate of interest or the real exchange rate.

Of course those conditions are not satisfied in the real world, hence the Feldstein (1983) views. Now applied welfare analysis has taught us it is not enough to say that we do not live in an Arrow-Debreu world, careful spelling out of specific market failures,policy induced distortions etc. is necessary if misleading policy advice is to be avoided.

In this paper we follow that line. The focus is on distortionary taxes, commodity taxes to be specific. The setting is a full general equilibrium two-country two-period model, with perfect capital markets,[1/] consumers endowed with perfect foresight and intertemporal optimization underlying private behaviour. At the core of much of the analysis and the results is the relation between the structure of taxation over time and the intertemporal terms of trade.

The structure of the paper is as follows : in section 2 we introduce the relation between tax structure, interest rates and deficits in a simple one commodity per period-two period-two country model. In this section we also briefly discuss the Bergsten proposal for what amounts to a tax on foreign borrowing. Section 3 presents the full two goods per period -two country-two period model, allowing us to discuss real exchange rate effects of fiscal deficits, and, at the end, returns to the Bergsten proposal in the light of the real exchange rate effects just derived. Section 4 concludes and discusses possible extensions.

1/. An analysis of fiscal policy with imperfect capital markets and contract based wage-price rigidity is presented elsewhere (van Wijnbergen (1984c).

2. Tax Structure, Fiscal Deficits and the World Rate of Interest

In this section we lead up to the full analysis of Section 3 by presenting a simplified one commodity version of the model used there, to illustrate some of the mechanisms at work. We first introduce a one commodity per period - two country - two period model with optimising consumers, and outline the tax structure (an intertemporal variant of the Ramsey rule) from which we assume the government to make a small deficit increasing departure. We assume that the tax structure prevailing before the marginal changes analysed in this paper conforms to that intertemporal Ramsey rule not because that is realistic but because we do not wish to clutter the analysis with welfare effects due to changes towards or further away from the optimal tax structure, a quite separate issue.

Consider then two countries, without nontraded goods and with fixed terms of trade so that all commodities per period can be aggregated into one Hicks-composite good. There are two time periods, today and tomorrow, labeled 1 and 2 respectively. Output in both periods (X_1 and X_2 in the home country, X_1^* and X_2^* abroad; stars indicate foreign variables) is exogenous and investment is ignored (but could easily be introduced). Capital markets in both countries are perfect and fully integrated with each other, so that one world rate of interest, r, prevails in both capital markets. It will be notationally convenient to work with the discount factor $\delta = 1/(1 + r)$. In this section the only distortionary effect of commodity taxes (at a rate t_1 and t_2 for each period in the home country, and absent abroad) is their impact on the <u>intertemporal</u> allocations of consumption.

Private expenditure behaviour can be represented by an expenditure function giving the minimum discounted value of expenditure at tax-inclusive prices necessary to achieve welfare level U ;

$$E = E(1 + t_1, \delta(1 + t_2), U) \tag{1a}$$

and equivalently for foreigners

$$E^* = E^* (1, \delta, U^*) \tag{1b}$$

with U (U^*) domestic (foreign) private welfare. The first two partial derivatives of E and E^* (referred to as E_1 etc.) equal real expenditure by home country consumers and foreigners respectively in the corresponding periods via standard properties of the expenditure function (see Ch. 2 in Dixit and Norman (1980)).

The private sector budget constraint equals

$$X_1 + \delta X_2 = E(1 + t_1, \delta(1 + t_2), U) \tag{2a}$$

and

$$X_1^* + \delta X_2^* = E^*(1, \delta, U^*) \tag{2b}$$

Note that E and E^* are at tax-inclusive prices. Income or lump sum taxes would have shown up on the left hand side of (2a,b).

The home country government also faces an intertemporal budget constraint:

$$G_1 + \delta G_2 = t_1 E_1 + \delta t_2 E_2 \tag{3}$$

with G_i government expenditure in period i. We assume for simplicity that foreign government expenditure and taxes are zero. G_1 and G_2 will be kept fixed throughout the analysis, which focuses on pure fiscal policy, so we do not have to address the tricky question of the relation between private welfare U, government expenditure and private expenditure. Sinc G_1 and G_2 are fixed anyhow we may as well make the simplest possible assumption : G_1 and G_2 have no effect on U.

The government budget constraint (3) clearly establishes a relation between t_1, t_2 and U :

$$t_2 = t_2(t_1 , U) \tag{3a}$$

If we insert (3a) in (2a) and differentiate through to find the tax rate t_1 (and therefore t_2) that sets $\frac{dU}{dt_1} = 0$, we get a simple intertemporal variant of the Ramsey rule; defining the optimal tax structure over time :

$$\frac{(1 + t_2)}{(1 + t_1)} \cdot \frac{t_1}{t_2} = \frac{\varepsilon_2}{\varepsilon_1} \tag{4}$$

where $\varepsilon_1 = E_{11}(1 + t_1)/E_1$ and $\varepsilon_2 = E_{22}\delta(1 + t_2)/E_2$.

We will assume that the tax shift towards the future and ensuing deficits analysed in what follows start from the Ramsey structure defined in (4), to avoid uninteresting complications due to welfare changes caused by a tax shift representing a move towards or further away from the optimal tax structure. This has the attractive consequence that U will not be affected by small changes in t_1 (since the initial value of E_1 is at a level where $dU/dt_1 = 0$). Extensions to non-optimal starting points are left to the interested reader.

The model is closed by a first period goods market clearing condition (the second period goods market clearing condition is redundant via Walras' law):

$$X_1 + X_1^* = E_1 + E_1^* + G_1 \tag{5a}$$

which can be rearranged :

$$(X_1 - T_1 - E_1 + T_1 - g_1) + (X_1^* - E_1^*) = 0$$

private saving   government saving   foreign saving

or

$$CA_1 + CA_1^* = 0 \qquad (5b)$$

where CA_1 is the first period Balance of Payments surplus on Current Account of the home country (with obvious definition of CA_1^*)1/. (5b) simply says that the world current account has to equal zero.

Furthermore homogeneity of degree zero of the Hicksian demand functions E_i, E_i^* allows us to write $E_1 = E_1(1,(1 + t_2)\delta/(1 + t_1),U)$ and similarly for E_i^*. Finally use (1)-(4) to substitute out U and U^* (noting that (4) implies $\frac{\partial U}{\partial t_1} = 0$) so that we can rewrite (5b) as

$$CA_i\left(\frac{\delta(1 + t_2)}{(1 + t_1)}\right) + CA_1^*(\delta) = 0 \qquad (5c)$$

$\delta_c = \delta(1 + t_2) / (1 + t_1)$ is the consumption discount factor, the (tax-inclusive) price of future consumption goods in terms of current consumption goods. $\delta_c = 1 / (1 + CRI)$, where CRI is the Consumption Rate of Interest familiar from the cost benefit analysis literature (cf Little and Mirrlees (1974)). A diagrammatic representation of (5c) is given in fig. 1.

1/. Since there is no initial debt, there are no first period interest payments so the Current Account equals the Trade Balance in the first period.

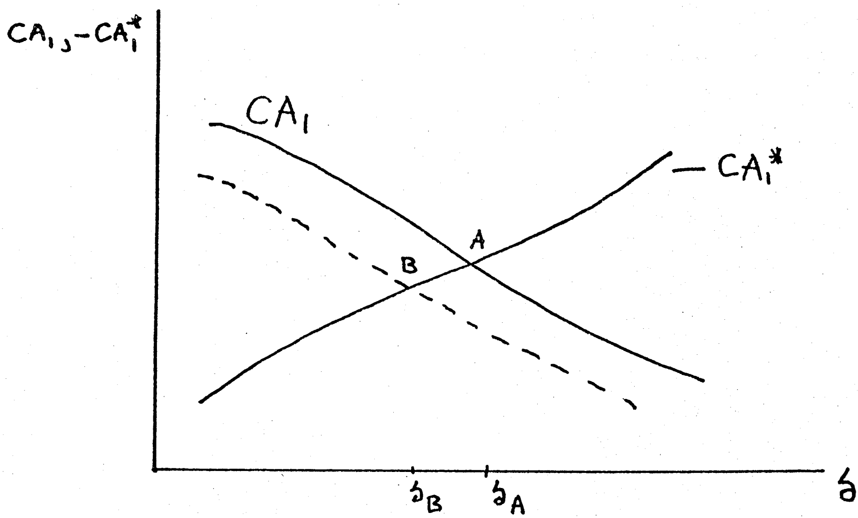

Fig.1 : Domestic CA surplus and foreign CA^* deficit as a function of the discount factor $\delta(= 1/(1 + r)$, where r is the real rate on world capital markets). The intersection of the axes does not necessarily correspond to zero on either axis.

A lower world interest rate or, equivalently, a higher value for δ , will lead to pure substitution effects deteriorating the domestic and foreign CA, so that $CA_1(\delta_c)$ slopes downward and $- CA_1^*(\delta)$, which measures foreign deficits on current account upwards.

A commodity tax shift towards the future will influence the Consumption Discount Factor δ_c at home (the rate at which future consumption can be exchanged agains current consumption) :

$$\left.\frac{d\delta_c}{dt_1}\right|_{\delta = \bar{\delta}} = \frac{\partial\delta_c}{\partial t_1} + \frac{\partial\delta_c}{\partial t_2}\frac{\partial t_1}{\partial t_2} \qquad (7)$$

$$= -\delta_c \left(\frac{1}{1+t_1} - \frac{1}{1+t_2}\frac{\partial t_2}{\partial t_1}\right) < 0$$

(Note that $\frac{\partial t_2}{\partial t_1} < 0$, so (7) holds unambiguously).

This implies that a <u>decrease</u> in t_1 with equal present value increase in t_2 will <u>increase</u> the consumption discount factor in the home country, causing a <u>pure substitution</u> shift away from future goods towards current goods (income effects are zero because we start from the Ramsey structure). This in turn shifts the CA schedule downward at given world interest rates (cf. fig.1), leading to an incipient world current account deficit. To get back in equilibrium the world interest rate has to increase (δ falls from δ_A to δ_B in fig.1), so that a foreign surplus will offset our government deficit induced CA deficit.[1/]

Formally this can be seen by differentiating (2a,b), inserting the resulting expressions for dU and dU^* plus $t_2 = t_2(t_1)$ into (6) to get an expression for $d\delta/dt_1$:

$$\frac{d\delta}{dt_1} = \frac{E_{12} \left.\frac{d\delta c}{dt_1}\right|_{\delta = \bar{\delta}}}{E_{12}(1 + t_2)/(1 + t_1) + E^*_{12} + (C_{IE} - C^*_{IE})\, CA_2} > 0 \qquad \ldots\ldots \quad (8)$$

E_{12} and E^*_{12} measure pure subsitution effects of interest changes on intertemporal expenditure allocation and are always positive. The inequality in (8) assumes sufficiently symmetric spending patterns or sufficiently small intitial CA imbalances so that the <u>differential</u> income effects term $(C_{IE} - C^*_{IE})\, CA_2$ does not dominate when negative.[2/] Symmetric expenditure patterns ($C_{IE} = C^*_{IE}$, perhaps the most natural assumption) or a zero initial current account balance $CA_2 = 0$ would

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1/. Which itself will be reduced but not reversed by the higher world interest rate.

2/. $C_{IE} = E_{1U}/E_U$, the marginal propensity to spend "today". Similarly for C^*_{IE}.

eliminate the differential income term altogether. (8) establishes that a deficit induced cut in commodity taxes today balanced by an equal present value tax increase tomorrow $(dt_1 < 0)$ pushes up the world rate of interest because of its effect on the intertemporal terms of trade at home $(\delta_c = \delta(1 + t_2) / (1 + t_1)$ and the ensuing shift in private domestic expenditure from future to current consumption. It should perhaps be stressed that this effect does not depend on trivial disposable income effects arising from static Keynesian consumption functions, but on the more subtle channel via the intertemporal terms of trade. A cut in lump sum taxes today balanced by an equal present value increase tomorrow (increasing today's disposable income but cutting tomorrow's) would be completely neutral and have no effect whatsoever on either CA_1, private expenditure or the world rate of interest.

Before going to a two goods per period model to discuss real exchange rate effects, we will briefly discuss the Bergsten proposal for an interest equalisation tax, which given the current circumstances, would amount to a tax on current foreign borrowing by the US.

A convenient parameterization of such a tax is presented in Marion and Svensson (1983) :

$$\bar{\delta} = \delta - b \qquad (9)$$

with $\bar{\delta}$ the tax inclusive discount factor facing borrowers in the country imposing the tax. Simple manipulation shows that $b = (\bar{r} - r) / [(1 + \bar{r})(1 + r)]$ with obvious definition of $\bar{r}$. b equals the discounted value of tax payments per unit repaid to foreigners. Introducing b into the model modifies (2a) and (5c) :

$$X_1 + \bar{\delta}X_2 + bCA_2 = E(1 + t_1, \bar{\delta}(1 + t_2), U) \quad (5c)$$

and

$$CA_1\left(\frac{\bar{\delta}(1 + t_2)}{(1 + t_1)}\right) + CA_1^*(\delta) = 0 \quad (5d)$$

bCA_2 represents the tax revenues, assumed to be handed out again by the government. Imposing such a tax will have rather similar consequences to the tax shift although of course in opposite directions : the CA_1 schedule shifts up and the CA_1^* does not. Fig. 1 can be used to see the results since the effect is the reverse of what happens after the tax shift. Formally, starting from $b = 0$, we get

$$\frac{d\delta}{db} = \frac{E_{12}\ (1 + t_2)/(1 + t_1)}{E_{12}\ (1 + t_2)/(1 + t_1) + E_{12}^* + (C_{IE} - C_{IE}^*)\ CA_2} > 0 \quad \ldots \quad (10)$$

Also if b is implemented after the tax shift has occurred <u>and</u> if we assume that <u>before the tax shift</u> $CA_1 = -\delta CA_2 = 0$, $C_{IE} = C_{IE}^*$ (symmetric preferences) then $CA_2 = -\delta^{-1}CA_1 > 0$ and $C_{IE} > C_{IE}^*$ after the tax change so $0 < \frac{d\delta}{db} < 1$.[1/] So domestic tax inclusive interest rates will increase and world, tax exclusive, interest rates will fall.

Of more interest are the welfare effects. It is straightforward to show that for a small tax increase evaluated at zero starting point, one gets

$$E_U \frac{dU}{db} = CA_2 \frac{d\delta}{db} \gtrless 0 \ \underline{\text{if}} \quad CA_2 \gtrless 0 \quad (11a)$$

1/. Clearly these conditions are sufficient but by no means necessary.

and

$$E_U^* \frac{dU^*}{db} = - CA_2 \frac{d\delta}{db} \lessgtr 0 \ \underline{\text{iff}} \ CA_2 \gtrless 0 \qquad (11b)$$

(11a,b) show two things. One is that the Bergsten tax is a beggar thy neightbour policy in that for small b "our" gain equals "their" loss. For a large tax it is even worse, since it is simple to show that in that case "their loss" will exceed our "gain" because of global efficiency losses, exactly analogous to standard optimal tariff arguments. The second thing is that that analogy with optimal tariffs is not coincidental since that is exactly what is going on: $\frac{dU}{db} > 0$ if $CA_2 > 0$ means that if we are net exporters of future goods ($CA_2 > 0$), a tax that improves their price in terms of current goods (pushes up δ) will be beneficial for us in exact analogy with the optimal tariff literature. The Bergsten tax can be construed as an (optimal when chosen correctly) tax on future goods, which will help net exporters of future goods (current borrowers) and harm net importers of future goods (current lenders). In terms of the current situation, the US and the LDC's would gain and OPEC and Japan would lose. This line of reasoning is presented also in Marion and Svensson (1983).

If one follows them and Bergsten in calling for US use of monopoly power, effectively against OPEC, one should bear in mind an important qualification. OPEC might (and will, if it follows the Hotelling rule) respond. A lower world rate of interest will under the Hotelling rule lead to higher current oil prices (and lower future prices, but less so than the increase in the discount factor of course). I have shown elsewhere, using recent results on optimal tariff structure in 3 good models, that the net results might be a sign reversal of $\frac{dU}{db}$ even if $CA_2 > 0$: it is possible that the welfare effects of the terms of trade gain in the "market for future final goods" is more than offset by welfare losses because of the induced higher oil prices (van Wijnbergen, (1983)).

Of course the Bergsten proposal was made in response to the high exchange value of the dollar. We will therefore briefly return to it at the end of the next section, where the real exchange rate is the focus of attention.

3. Deficit Spending, the Real Exchange Rate and the World Rate of Interest.

In this section we will extend the analysis of the previous section to a two commodity setting, which will allow us to discuss the real exchange rate and its response to tax policy. We will maintain the assumption that there are no NT goods, but now we allow the terms of trade between goods produced "at home" and "abroad" to vary within each period. This implies that we follow the Mundell-Fleming structure of complete specialization in each country.

Call the relative price of home goods in terms of foreign goods 1/ in period i p_i. We will refer to the terms of trade p_i as the real exchange rate (an increase in p_i represents an appreciation).

We will furthermore assume that utility in each country is Weakly Identically Homothetically Separable, $U = U\ (V_1(C_D^1\ ,\ C_F^1),\ V_2(C_D^2\ ,\ C_F^2))$

1/ where "home" is associated with the country increasing its fiscal deficit.

with C_j^i consumption in period i of good j. Separability allows us to define aggregate price indices π_1 and π_2 dependent on within period variables only. It is easily shown that the π_i are in fact unit expenditure functions. Homotheticity is not essential but convenient since it makes the unit expenditure functions π_i independent of the level of expenditure; while the requirement that V_1 and V_2 are identical functions (which may of course take different values if their arguments do) allows the definition of a consumption discount factor $\delta\pi_2/\pi_1$, the relative price of future consumption in terms of current consumption.

The private budget constraint in each country now becomes

$$p_1X_1 + \delta\, p_2X_2 = E\ (\pi_1(p_1, 1) + t_1, \delta(\pi_2(p_2, 1) + t_2), U) \qquad \ldots \text{(12a)}$$

and

$$X_1^* + \delta\, X_2^* = E^*\ (\pi_1^*\ (p_1, 1),\ \ \delta\ \pi_2^*\ (p_2, 1), U^*) \qquad \text{(12b)}$$

where we madethe simplifying but inessential assumption that commodity taxes in the home country are specific (i.e. not proportional) and the same on each good within the period, although potentially different in different time periods. We can once again use the government budget constraint and equation (12a) to derive the tax structure at which

$$\frac{dU}{dt_1} = 0 \qquad \text{(13)}$$

We will not again do this explicitly but assume that the initial tax structure is such that (13) holds (see the previous section for more details).

It is straightforward to show that differentiation of (12) yields

$$E_U \, dU = E^*_{p_1} \, dp_1 + E^*_{p_2} + CA_2 \, d\delta \quad \underline{1/} \tag{14a}$$

and

$$E^*_U \, dU^* = - E^*_{p_1} \, dp_1 - E^*_{p_2} \, \delta \, dp_2 - CA_2 \, d\delta \tag{14b}$$

The first period goods market clearing equation for home goods now becomes

$$X_1 = E_{p_1} + E^*_{p_1} + G_1 \tag{15}$$

Differentiation of (15) and insertion of (14a,b) shows that (15) for given discount factor δ , describes and upward sloping locus in $p_1 - p_2$ space (cf fig. 2) $\underline{2/}$:

$$\left. \frac{dp_1}{dp_2} \right|_{\substack{GM1 \\ \delta=\overline{\delta}}} = \frac{-(E_{p_1p_2} + E^*_{p_1p_2} + (C_{2E} - C^*_{2E}) \, E^*_{p_1})}{(E_{p_1p_1} + E^*_{p_1p_1} + (C_{1E} - C^*_{1E}) \, E^*_{p_1}} > 0 \qquad \ldots (16)$$

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1. $CA_2 = -\delta^{-1}\dot{C}A_2$. To be precise, $CA_2 (= p_2X_2 - \pi_2E_{\pi_2} - p_2G_2)$ corresponds to the trade balance, not to the current account. (14a,b) also incorporate the simplifying but unnecessary assumption that G_1, G_2 are such that before the tax change the government budget is balanced in each period.

2. $C_{1E} = E_{p_1U} / E_U$ etc. We assume throughout that <u>differential</u> income effects $((C_{2E} - C^*_{2E}) \, E^*_{p_2}$ etc.) do not dominate substitution effects. Differential refers to the fact that the income effects term measures "our" income effect $C_{2E} \, E^*_{p_2}$ <u>minus</u> "their" income effect $C^*_{2E}E^*_{p_2}$. This implies that the two countries are not too asymmetric.

The reason is simple : an increase in p_2 will lead to substitution away from period two home goods. The WIHS utility structure rules out complementarity so at least some extra demand falls on today's goods ($E_{p_1p_2}$, $E^*_{p_1p_2}$ > 0). To get back at equilibrium the price of today's goods will have to increase:

$$\left.\frac{dp_1}{dp_2}\right|_{GM1} > 0.$$

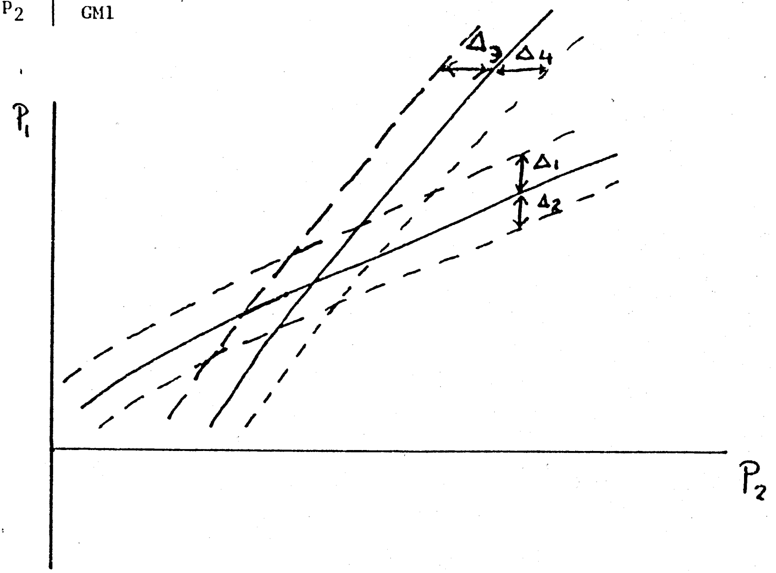

Fig.2 Period one (GM1 and GM2) goods market schedules in p_1-p_2 space.

A tax change $dt_1 < 0$ (with t_2 adjusted to satisfy the intertemporal budget constraint) will given the discount factors and therefore the interest rate, shift the GM1 curve up for reasons similar to those presented in the previous section. A decrease in t_1, and increase in t_2 increases the consumption discount factor $\delta(\pi_2 + t_2)/(\pi_1 + t_1)$, and shifts home expenditure towards today's goods :

$$\left.\frac{dp_1}{dt_1}\right|_{GM1} = \frac{-\left(E_{p_1\tilde{\pi}_1} + E_{p_1\tilde{\pi}_2}\ \delta \dfrac{\partial t_2}{\partial t_1} \right)}{\left(E_{p_1p_1} + E^*_{p_1p_1} + (C_{1E} - C^*_{1E})\ E^*_{p_1} \right)} < 0 \qquad \text{... (17)}$$

(A negative sign for (17) implies an upward shift in fig.2 since we are analysing a tax <u>cut</u>, $dt_1 < 0$). $\tilde{\pi}_1 = \pi_1 + t_1$ and $\tilde{\pi}_2 = \pi_2 + t_2$.

However fig. 2 is not an adequate representation of eq.(15), since changes in the discount factors will also disturb first period goods market equilibrium :

$$\left.\frac{dp_1}{d\delta}\right|_{GM1} = \frac{\left(E_{p_1\pi_1}\ \tilde{\pi}_2 + E^*_{p_1\pi_2}\ \pi^*_2 + (C_{1E} - C^*_{1E})\ CA_2 \right)}{\left(E_{p_1p_1} + E^*_{p_1p_1} + (C_{1E} - C^*_{1E})\ E^*_{p_1} \right.} > 0 \qquad \text{... (18}$$

So a <u>decrease</u> in δ would shift GM1 down (Δ_2 in fig.2; we look at a decrease since that is what happens after a cut in t_1).

Similar expressions can be derived for the second period home goods market clearing equation :

$$X_2 = E_{p_2} + E^*_{p_2} + G_2 \qquad (19)$$

(19) also corresponds to an upward sloping schedule in $p_1 - p_2$ space for given δ , for a similar reason : a higher p_1 increases the consumption discount factor $\delta\hat{\pi} / \tilde{\pi}_1$ and so leads to more expenditure tomorrow and less today, putting upward pressure on p_2. Dominance of own substitution effects over cross substitution effects guarantees that GM2 is steeper than GM1.

A tax shift towards the future will shift expenditure away from period two, leading to a backward shift of GM2 (Δ_3 in fig.2). On the other hand a fall in the discount factor δ (a higher world rate of interest) will shift expenditure to the future via pure substitution effects and so push out GM2 (Δ_4 in fig.2).[1/]

The model is closed by the first period goods market clearing condition for foreign goods : the corresponding second period foreign goods market clearing condition is redundant via Walras' law : [2/]

$$X_1^* = E_{f_1} + E^*_{f_1} \qquad (20a)$$

Combining this with (15) gives after some simple manipulation an equivalent relation :

$$p_1 X_1 - p_1 G_1 - \pi_1 E_{\pi_1} + X_1^* - \pi_1^* E^*_{\pi_1} = 0 \qquad (20b)$$

or

$$CA_1 + CA_1^* = 0 \qquad (20c)$$

(20) represents a negative locus in $p_2 - \delta$ space for given p_1. The precise expression for the slope is rather forbidding [3/] ;

1/. Precise expressions for these slopes and shifts can easily be derived from the model equations in differentiated form presented in Appendix 1 , which is available on request.

2/. $E_{f_1}, E^*_{f_1}$ in (20a) represent the partial derivatives with respect to period one foreign prices, f_1 .

3/. $C_{IE} = E_{\pi_1 U} / E_U$ and $C^*_{IE} = E^*_{\pi_1 U} / E^*_U$.

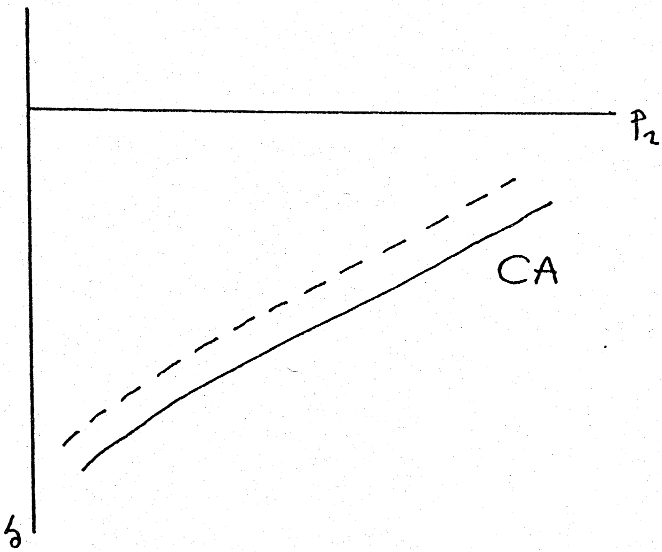

Fig.3 World Current Account equals zero schedule.

$$\left.\frac{d\delta}{dp_2}\right|_{\substack{CA \\ p_1=\bar{p}_1}} = - \frac{(\tilde{E}_{\pi_1 p_2}\,\pi_1 + E^*_{\pi_1 p_2}\,\pi_1^* + (C_{IE}\,\pi_1 - C^*_{IE}\,\pi_1^*)\,E^*_{p_2}}{(E_{\pi_1\pi_2}\,\pi_1\,\tilde{\pi}_2 + E^*_{\pi_1\pi_2}\,\pi_1^*\pi_2^* + (C_{IE}\pi_1 - C^*_{IE}\pi_1^*)CA_2} < 0 \qquad \ldots(21)$$

where we once again assume that <u>differential</u> income effects are not sufficiently negative to offset substitution terms, i.e. the two countries are not too asymmetric.

A tax shift towards tomorrow shifts home expenditure towards today, leading to an incipient world CA deficit : for given relative prices a higher world interest rate (lower discount factor δ) will restore equilibrium (the CA curve shifts North in fig. 3. Keep in mind that δ increases as we go down along the δ-axis). The precise expression for the size of the shift becomes important below, so we spell it out explicitly :

$$\left.\frac{d\delta}{dt_1}\right|_{CA} = - \frac{\left(E_{\pi_1\pi_1} + E_{\pi_1\pi_2}\frac{\partial t_2}{\partial t_1}\pi_1\right)}{\left(E_{\pi_1\pi_2}\tilde{\pi}_1\pi_2 + E^*_{\pi_1\pi_2}\pi_1^*\pi_2^* + (C_{IE}\pi_1 - C^*_{IE}\pi_1^*)\, CA_2\right)} \quad \ldots (22)$$

We are now ready for the analysis of the tax shift. Since the full algebraic solution is rather lengthy and tedious it is relegated to Appendix A.2 and we present an analysis based on fig.2 and fig.3 and the expression for shifts given in this section (see fig.4).

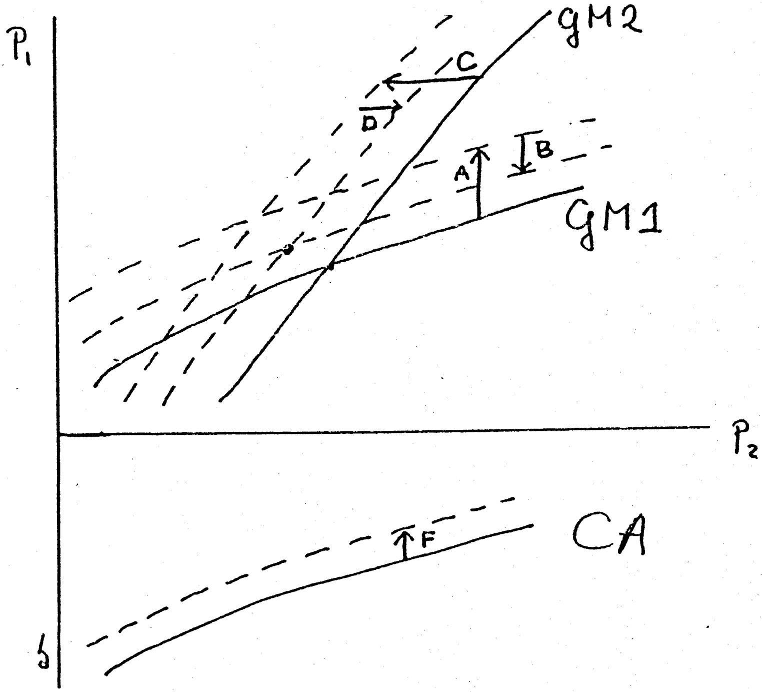

Fig.4 Interest Rates, current and future exchange rates and the effects of a home country tax cut.

Consider then a tax cut in commodity taxes today, balanced by an equal present value cut in taxes tomorrow. For given values of the real exchange rate in both periods (p_1, p_2), home country consumers will now face <u>intertemporal</u> terms of trade more unfavourable to future consumption : eq.(7) tells us that

$$dt_1 < 0 \Rightarrow \frac{\partial \delta_c}{\partial t_1} dt_1 > 0$$

This in turn will shift home expenditure towards today, shifting down the CA curve : the world interest rate has to increase $(\delta\downarrow)$ to maintain the world current account at zero. This we have already seen. Now what happens to goods markets and therefore the real exchange rate ?

Two things disturb today's goods market : first the tax changes shifts <u>our</u> expenditure towards today, putting upward pressure on p_1 ; second the higher interest rate limits that and, more important, shifts foreign expenditure, which is not directly affected by the tax change, towards tomorrow, relieving pressure on today's goods markets. The first effect corresponds to shift A in fig.4, the second to shift B. Similar arguments, of course in opposite direction (lowering and increasing excess demand respectively) apply to our second period goods market schedule, GM2 (shift C and D in fig.4).

Is that all we can say, shifts occur in potentially offsetting directions, leaving us with ambiguity all over ? The answer is <u>no</u>, there is a very intuitive and simple condition under which shift A will dominate B (and C over D), leading to an appreciation today and a real depreciation tomorrow.

Consider the algebraic expression for the two shift. The question is whether on balance GM1 goes up or down (our increased expenditure today dominates means it goes up, the reduction in foreign expenditure dominates it implies it shifts down). Formally this question boils down to

$$\left.\frac{\partial p_1}{\partial t_1}\right|_{GM1} + \left.\frac{\partial p_1}{\partial \delta}\right|_{GM1} \left.\frac{\partial \delta}{\partial t_1}\right|_{CA} \gtrless 0 \qquad (23)$$

$$(-) \qquad\qquad (-) \qquad\qquad (-)$$

Inserting expressions (17), (18) and (22) into (23), and making repeated use of the properties of expenditure functions and the fact that $\hat{\pi}_i$ and π^*_i represent unit expenditure functions yields an easily interpretable expression for (23) :

$$\left.\frac{\partial p_1}{\partial t_1}\right|_{GM1} + \left.\frac{\partial p_1}{\partial \delta}\right|_{GM1} \left.\frac{\partial \delta}{\partial t_1}\right|_{CA} =$$

$$- \psi \left(1 - \frac{\pi_1}{\pi^*_1} \frac{\pi^*_{1p_1}}{\pi_{1p_1}} \right) \qquad \ldots \quad (24)$$

where

$$\psi = \frac{E^*_{\pi_1\pi_2} \pi^*_1 \pi^*_2}{E_{\pi_1\pi_2} \pi_1 \pi_2 + E^*_{\pi_1\pi_2} \pi^*_1 \pi^*_2} > 0$$

Now the condition

$$\frac{\pi_1}{\pi^*_1} \frac{\pi_{1p_1}}{\pi^*_{1p_1}} \gtrless 1$$

can easily be shown to correspond to the famous Metzler condition for a transfer being under or over-effected :

$$\frac{\pi_1}{\pi_1^*} \frac{\pi_{1p_1}}{\pi^*_{1p_1}} \gtrless 1 \iff \frac{\pi_{1f_1}}{p_1\pi_{1p_1}} \gtrless \frac{\pi^*_{1f_1}}{p_1\pi^*_{1p_1}} \qquad (25)$$

Since the π_i's are unit expenditure functions, $\pi^*_{1f_1}$ and π_{1f_1} are foreign and domestic expenditure shares foreign goods and $p_1\pi^*_1$ and $p_1\pi_1$ are foreign and domestic expenditure shares on our goods. So if

$$\frac{\pi_{1f_1}}{p_1\pi_{1p_1}} < \frac{\pi^*_{1f_1}}{p_1\pi^*_1\, p_1}$$

we spend more on our goods (per unit of expenditure) than foreigners spend on our goods. This is nothing but the well-known Metzler condition $m + m^* < 1$ for an under-effected transfer. If that condition holds, if we spend more on our goods (per unit of total expenditure), than foreigners spend on our goods (also per unit of their total expenditure), (23) and (24) are negative, the first term ($\left.\frac{\partial p_1}{\partial t_1}\right|_{GMI}$) is the bigger shift (in absolute value terms)and a tax cut today ($dt_1 < 0$) will on balance shift GM1 up. Similar arguments show that in that case GM2 will shift to the left, which will lead to excess demand for our goods today and excess supply tomorrow, so in that case we will have a real appreciation today and a real depreciation tomorrow after a deficit inducing commodity tax cut today. The intuition behind this reult is simple. A commodity tax cut today balanced by an increase tomorrow at given relative prices will shift our expenditure towards today, but the resulting increase in the real rate will shift their expenditure towards the future. Since world income is fixed, total world expenditure will remain unchanged also.

All that has happened therefore is that the composition of world expenditure has changed : in period 1 we spend more but foreigners less (and vice versa tomorrow) for given totals. Therefore if expenditure patterns are completely symmetric , if $m + m^* = 1$ in terms of Metzler's condition or if

$$\frac{\pi_1 f_1}{p_1 \pi_1 p_1} = \frac{\pi^*_1 f_1}{p_1 \pi^*_1 p_1}$$

in terms of our equivalent one, fiscal deficits caused by a cut in commodity taxes will have no real exchange rate effects at all either today or tomorrow.

If on the other hand we spend proportionately more on our own goods than foreigners on our goods (

$$\frac{\pi_1 p_1}{p_1 \pi_1 p_1} < \frac{\pi^*_1 f_1}{p_1 \pi^*_1 p_1}$$

in our terms or equivalently, $m + m^* < 1$ in terms of Metzler's condition), a commodity tax cut induced deficit today will lead to a real appreciation today and a real depreciation tomorrow.

Within the context of our model there is no natural presumption either way. In fact Samuelson (1952) argues for symmetry as the natural assumption in his discussion of the Keynes-Ohlin discussion of the transfer problem. On the other hand it is I think clearly true that the existence of non-traded goods or more generally transport costs (none of which are modelled here) make a strong case for the Metzler condition for an undereffected transfer to hold in the real world. This implies that our conditions (23) or (24) are negative, that deficits cause a real appreciation today and a depreciation tomorrow, lending support to the Feldstein view discussed in the introduction.

The real interest rate effects are independent of the Metzler condition, a commodity tax cut induced deficit will always cause higher real world interest rates.

Before we conclude, a brief return to the Bergsten proposal discussed at the end of Section 2, since Bergsten proposed what amounts to a tax on foreign borrowing in response to the high value of the dollar. First of all it is straightforward to show that the same condition that guarantees a period 1 appreciation in response to a deficit also guarantees a depreciation in response to such a tax. In that sense it would work in terms of bringing real exchange rate down. That does not mean however that it will do so and improve "our" welfare.

Two points are in order. The argument in favour of the Bergsten tax is still a beggar-thy-neighbour policy analogous to optimal tariff arguments, with the same qualifications made before. Second it will bring the exchange rate down but may lower "our", and certainly foreign, welfare in the process. The appreciation, at least within the context of our model, is a perfectly rational and efficient response to the increased deficits. Not liking the high dollar means not liking deficit spending, and following Bhagwati-Srinivasan "targeting" principles, one should in that case reduce deficits, not sustain deficits and compound welfare losses by introducing disortionary measures fighting the symptons rather than the cure.

If there are production externalities in export sectors the cost of which increases with appreciation, a case could be made for production subsidies; however if such externalities exist, such subsidies would have been in order before the appreciation also. I have shown elsewhere (van Wijnbergen (1984a)) in a discussion of the appreciation caused by oil revenues, that it is not at all obvious in the presence of well functioning capital markets, that such subsidies should be increased after an appreciation, Moreover, such externalities in export sectors may call for production subsidies etc, but not for a tax on foreign borrowing.

4. Conclusion

In this paper we used a full general equilibrium two country two period two goods model to analyse the effects of a commodity tax cut triggered deficit increase on the current account and the real exchange rate of the tax cut country and the world rate of interest. We assume that capital markets are perfect and that consumers in both countries have perfect foresight and base their intra-and intertemporal allocation of consumption on optimizing behaviour.

The results are quite intuitive. The change in the tax structure caused by the commodity tax cut will shift the intertemporal terms of trade in the home country; pure substitution effects will then shift home expenditure towards today, leading to an incipient world CA deficit. This will lead to an increase in the world interest rate until the world CA is back to zero by shifting both our and foreign expenditure towards the future. The net effect is that home period 1 expenditure has gone up and foreign period 1 expenditure down. The effects on the real exchange rate are shown to depend on spending patterns at home relative to those abroad. If the Metzler condition for an undereffected transfer holds, if home consumers spend proportionally more on our goods than foreigners spend on our goods, the increased deficit will lead to a real appreciation of the country where the government deficit has gone up. If spending patterns are symmetric, deficit spending will have no effect on the exchange rate. In the real world transport costs etc make the Metzler condition likely to obtain in practice leading to support for the emerging consensus on the causal link between high budget deficits and appreciation of the real exchange rate, high real world rates of interest and increasing CA deficits in the country running the government budget deficit.

The results are quite intuitive and simple; do we need such a complicated model to establish them ? It is of course possible to formulate an _ad hoc_ model that will give similar results; however one can, as some of the literature demonstrates, also give equally plausible _ad hoc_ models that will not. It is precisely to avoid such arbitrariness that rigorous general equilibrium models are needed. Within that restriction I think we have given the simplest one acceptable.

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