BUDGET DEFICITS AND THE CURRENT ACCOUNT IN THE PRESENCE OF CLASSICAL UNEMPLOYMENT

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November, 1984

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Banco de España. Servicio de Estudios
Documento de Trabajo n.º 8418

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ISBN: 84-505-0847-9

Depósito legal: M. 43458 - 1984

Talleres Gráficos del Banco de España

This paper has benefited from comments of participants in the Stanford University International Macro workshop. Any errors are our own responsibility.

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Abstract

This paper uses an intertemporal disequilibrium model of a monetary (i.e. cash-in-advance) economy to explain the effects of fiscal policy on the current account in the presence of flexible exchange rates and short-run real wage rigidity that gives rise to classical unemployment. The differing effects of alternative methods of financing government expenditures--by raising taxes, borrowing via the issue of government securities, or printing money--are considered within a microtheoretic optimizing framework. Our results are strikingly different from those of standard sticky wage-price rational expectations models as well as those of the new intertemporal Walrasian-equilibrium models. For example, we show that reducing government spending will, in the presence of classical unemployment, worsen the current account. This worsening is larger the more 'permanent' the policy shift is perceived to be. These results are contrary to the usual presumption based on the above-mentioned alternative models.

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I. Introduction

This paper uses an intertemporal disequilibrium model with a specific microtheory of money to explain the effects of fiscal policy on the current account in the presence of short-run classical unemployment and flexible exchange rates.

By way of motivation, it should be noted that most industrial countries incurred large budget deficits relative to GNP during the 1970s and early 1980s. It is claimed by some analysts that in addition to the dilatory effects on economic growth, budget deficits are at least partially responsible for some countries' deteriorating current account positions following the two OPEC oil price shocks. A recent study by the OECD (1983) states the presumed connection between budget deficits and the current account as follows:

> Firstly, independent budgetary action may be limited in its effects on domestic output (under managed or floating exchange rate regimes) since, because of the high integration of OECD economies through international trade, such action will be associated with current balance of payments deficits .... fiscal action may then lead to a form of 'exchange rate crowding out' where the budget deficit has its counterpart in a deficit on the current [account] balance of payments. (p.40).

Within the major industrial countries at the present time, there seems to be a concerted move towards budgetary restraint. According to the IMF, "Announced policy intentions for 1984 imply a tightening of the fiscal policy stance of the central government in all the major industial countries except the United States." (p. 27, World Economic Outlook,1984). In light of the importance of external balance considerations, not only for industrial countries but also for debt-ridden LDCs, the effect of this change in fiscal policy on the current account requires careful investigation.

There is, of course, a well-established theoretical presumption-- based on standard Keynesian models or the Mundell-Fleming model-- that fiscal contraction will improve the current account. In these models, the short-run effects of government spending and taxation on aggregate demand are of paramount importance. (See e.g. Branson and Buiter (1983) and Penati (1983)). Fiscal contraction decreases national income and/or causes a weakening of the domestic currency in the foreign exchange market. Both of these effects contribute to a fall in the demand for import goods, while the exchange rate depreciation raises exports. Hence, the trade balance improves.

There is an emerging view, however, that European unemployment has an important classical component, attributable to excessive real wage growth in the 1970s. 1/ This is not to deny the existence of a Keynesian component also, but it is widely believed that the classical component prevails at the margin. 2/ (The Annual Economic Report 1983-84 of the Commission of the European Communities, for example, supports this view.)

Unfortunately there are relatively few theoretical papers to guide us when analyzing the dependence of current account deficits on fiscal policy in the classical unemployment case. 3/ Of these papers, only Persson (1982) and van Wijnbergen (1984) are based on a current account specification that explicitly incorporates intertemporal considerations.

Recent intertemporal models of the current account (see, e.g. Obstfeld (1980), Sachs (1982), Dornbusch (1983), Svensson and Razin (1983)) focus on the well-known accounting identity that expresses the current account as the difference between domestic saving and domestic investment. They emphasize that both saving and investment, and hence the current account, are determined fundamentally by intertemporal considerations. In keeping with the

view that macroeconomic analyses ought to be based on the optimizing behavior by individual agents, these theories develop simple intertemporal general equilibrium models to explain current account patterns. Not surprisingly, the implications of these models often differ from those based on the standard atemporal models used in open-economy macroeconomics. 4/

Within the intertemporal framework, non-Walrasian equilibrium models have been discussed by Persson (1982), Neary-Stiglitz (1983), van Wijnbergen (1984) and Cuddington-Vinals (1984). Persson (1982) focuses on the effects of money-financed government spending and payroll tax changes on employment and welfare (but not the current account). His model contains a single (tradeable) good, and assumes classical unemployment prevails in both the short and long runs. Persson exploits the Clower cash-in-advance specification of money demand in an open economy developed in the seminal contribution of Helpman (1981)). Van Wijnbergen (1984) has analyzed the effects of fiscal policy on the current account in an intertemporal disequilibrium framework. His analysis focuses on the real side of the economy and abstracts completely from monetary considerations. In addition to van Wijnbergen's analysis of fiscal policy on the current account, the recent work of Frenkel and Razin (1984a,b) should be mentioned. They apply two-country, intertemporal equilibrium models to address the same question, but in a full employment, market clearing context. Like van Wijnbergen, their models are barter models and hence are incapable of discussing money-financed fiscal deficits. Both van Wijnbergen and Frenkel-Razin (1984b) relax the debt-neutrality assumption, which is employed throughout this paper, by introducing a wedge between private and public sector discount rates. 5/

The present paper and Cuddington-Vinals (1984) extend the intertemporal disequilibrium analysis of fiscal policy on the current account to a monetary economy by employing a cash-in-advance specification of money demand. In this context, it is possible to discuss monetization of fiscal deficits as well as tax or, equivalently (given our specification, which implies debt neutrality), bond finance. Furthermore, the presence of domestic and foreign monies in the model makes it possible to consider a flexible (or fixed) exchange rate system; this cannot, of course, be done in barter models.

The remainder of the paper is structured as follows: Section 2 lays out, in detail, the model used. Section 3 discusses market equilibrium and provides a simple diagrammatic characterization of it. Section 4 explores the connection between fiscal policy and the current account and Section 5 summarizes the main conclusions by comparing our results to those obtained from other models in the literature.

2. The Conceptual Framework

The model employed here is a perfect foresight, intertemporal disequilibrium model of a monetary economy. The economy has two sectors, which produce tradeables and nontradeables respectively in each of two periods ($t = 1, 2$). The country is assumed to be small in the world market, implying that tradeables can be bought or sold freely at the fixed foreign-currency price. Adopting the arbitrary normalization that this price equals unity, the domestic-currency price at time t can be taken as equal to the exchange rate e_t. It is assumed throughout that the country maintains a flexible exchange rate regime.

In the "short run" represented by period 1, the price of nontradeables p_1 and the domestic wage rate w_1 are fixed. We focus on the case

where the resulting disequilibrium is characterized by classical unemployment, i.e., unemployment whose proximate cause is excessive nominal wages relative to the prevailing prices of tradeable and nontradeable goods. The short-run wage-price stickiness is admittedly ad hoc in our model in that it is not rooted in the underlying optimization processes of the agents in the model. Although wages and the price of nontradables are fixed in the short run, however, they adjust to their Walrasian equilibrium levels in the "long run" represented by period 2. Furthermore, all economic agents have perfect foresight regarding future prices, p_2 and e_2, when they make their decisions in period 1. 6/

Financial considerations are of central importance in our model. Both the government and the private sector are assumed to be able to borrow or lend in a well-integrated world market at interest rate i_t^* when denominated in the foreign currency and i_t when denominated in the domestic currency. Given the absence of uncertainty in our framework, the open interest parity condition holds, and domestic and foreign bonds are perfect substitutes. Hence, in order to simplify the notation, it can be assumed that all borrowing is denominated in terms of foreign currency.

The economy is a monetary economy in the sense that all purchases of goods must be made using money; no direct barter transactions are allowed (presumably because of the prohibitive cost of achieving the so-called "double coincidence of wants" involved in barter). Furthermore, all goods must be paid for using the currency of the seller's country. Therefore all nontradables purchases require that purchasers use domestic money. 7/ Domestic demand for tradables, on the other hand, could give rise to a domestic demand for domestic or foreign money depending on the source of tradeables supply.

(Domestic and foreign tradeables are perfect substitutes.) In addition, foreign money must be used in period 2 to repay (with interest) any borrowing from foreigners in period 1.

This specification is, in short, the "S-system" described in the cash-in-advance models popularized in the open-economy context by Lucas, Helpman and Razin among others. 8/ In this specification financial markets open at the beginning of the period so that agents can borrow the appropriate levels of domestic and foreign money balances to carry out commodity market transactions in the remainder of the current period. 9/ Also any superfluous money balances can be exchanged for interest earning assets at the beginning of the period.

After the foregoing financial transactions (made with the benefit of perfect foresight regarding the upcoming commodity market transactions) are complete, production and sale of commodities occurs. It is not until the beginning of the following period that domestic firms distribute their income from production to domestic households or pay it to the government in the form of (lump-sum) taxes. 10/

A detailed discussion of the behavior of firms, households and the government follows.

2.A. The Production Sector

In each of the two periods, tradeables and nontradeables are produced using labor as the only variable factor of production. By assumption, the wage rate and the price of nontradeables at $t = 1$ are both fixed. The resulting real product wage in the nontradeables sector implies a profit maximizing level of output that falls short of the market clearing level. 11/

That is, firms find that domestic demand for nontradeables exceeds the quantity that they wish to supply given the high cost of labor:

$$(1) \qquad Y_{n1} = Y_{n1}(w_1/p_1).$$

As we shall see below, this implies that consumers will face short-run quantity constraints in the nontradeables market. In period 2, however, wage and price flexibility insure that notional supply and demand for nontradeables are brought into equality so that consumers no longer face demand constraints.

At $t = 1$, tradeables supply Y_{T1} depends positively on the real product wage w_1/e_1. Given that the price of nontradeables in period 1, p_1, is fixed and will be used as a numeraire below, it is convenient to note that $w_1/e_1 = (w_1/p_1)/\rho_1$, where $\rho_t \equiv e_t/p_t$ is the relative price of tradeables in terms of nontradeables or the <u>real exchange rate</u>. Y_{T1} can then be written as a positive function of ρ_1:

$$(2) \qquad Y_{T1} = Y_{T1}(\rho_1, w_1/p_1), \ \partial Y_{T1}/\partial \rho_1 > 0$$

We suppress the w_1/p_1 argument in both (1) and (2) in what follows to simplify the notation, as we do not consider changes in the real exogenous product wage at $t = 1$.

In period 2 where full employment prevails, the outputs of both tradeables and nontradeables depend on the relative price ρ_2 in the usual fashion:

$$(3) \qquad Y_{T2} = Y_{T2}(\rho_2) \qquad \partial Y_{T2}/\partial \rho_2 > 0$$

(4) $Y_{n2} = Y_{n2}(\rho_2) \qquad \partial Y_{n2}/\partial \rho_2 < 0$.

2.B. The Household Sector

The representative consumer is assumed to have an additive time-separable utility function of the log-linear form:

(5) $$U = (\alpha \ln C_{n1} + (1-\alpha)\ln C_{T1}) + \frac{1}{1+\delta}(\alpha \ln C_{n2} + (1-\alpha)\ln C_{T2})$$

where $0 < \alpha < 1$ and δ is the constant time preference rate. C_{nt} and C_{Tt} equal total domestic the consumption of nontradeables and tradeables respectively in period t.

The individual must engage in financial transactions at the beginning of the period in order to secure enough domestic and foreign money to buy the desired quantities of nontradeables and tradeables during the period. As mentioned above, it is assumed that goods must be paid for using the seller's currency. Hence, the cash-in-advance restrictions take the form:

(6) $$p_t C_{nt} + e_t C_{Tt}^H \leq M_t^H$$

(7) $$C_{Tt}^{*H} \leq M_t^{*H} \qquad ; t = 1, 2$$

where M_t^H, M_t^{*H} are the demands for domestic and foreign money by domestic households. C_{Tt}^H and C_{Tt}^{*H} are domestic demands for domestically-produced and foreign-produced tradeable goods respectively; they are perfect substitutes. By definition, total domestic demand for tradeables equals $C_{Tt} \equiv C_{Tt}^H + C_{Tt}^{*H}$. Provided the equilibrium interest rate is positive and there is no uncer-

tainty, money will be demanded only for transaction purposes. Individuals will not carry idle money balances forward from one period to another, implying that all domestic money outstanding is paid to domestic firms in order to purchase domestic output each period. Thus (6) and (7) will hold with strict equality; we assume this to be the case throughout our analysis.

At the beginning of each period (t=1,2), the representative consumer obtains domestic and foreign money from two sources: (1) domestic firms pay out all after-tax income generated in the previous period, (2) net increases in borrowing in the (domestic or foreign) bond markets can be used to acquire additional transactions balances. This implies the following financial transactions constraint:

$$e_t M^{*H}_t + M^H_t \leq (p_{t-1} Y_{n\,t-1} + e_{t-1} Y_{Tt-1}) - T_{t-1}$$
$$- (1+i^*_{t-1})\, e_t B_{t-1} + e_t B_t \qquad (8)$$

where B_t equals household borrowing which matures one period later. It is assumed that household debts are zero initially ($B_0 = 0$) and that all debt is repaid at the end of period 2 ($B_2 = 0$). Assuming no superflouous borrowing occurs, equation (8) holds with strict equality. 12/

Combining the cash-in-advance and financial transactions constraints in (6) - (8) yields a single, overall budget constraint for the household provided all of the weak inequalities hold as strict equalities, as assumed above:

$$p_1 C_{n1} + e_1 C_{T1} + \frac{1}{1+i^*} (p_2 C_{n2} + e_2 C_{T2}) = W_o \qquad (9)$$

where: 13/

$$(10) \qquad W_o = (p_o Y_{no} + e_o Y_{To} - T_o) + \frac{1}{1+i^*}(p_1 Y_{n1} + e_1 Y_{T1} - T_1).$$

As Appendix I shows, it is possible (following Helpman (1981)) to rewrite (10) in terms of income net of government spending in periods 1 and 2 (rather than disposable income at t = 0 and t = 1).

In the classical unemployment case, households face a quantity constraint $\bar{C}_{n1}$ on their purchases of nontradeables in period 1. Hence it is convenient to write the effective demand functions for unrationed goods in terms of residual wealth, $\tilde{W} = W_o - p_1\bar{C}_{n1}$:

$$(11) \qquad C_{T1} = \frac{(1-\alpha)(1+\delta)}{1+(1-\alpha)(1+\delta)} \frac{\tilde{W}}{e_1}$$

$$(12) \qquad C_{n2} = \frac{\alpha(1+i^*)}{1+(1-\alpha)(1+\delta)} \frac{\tilde{W}}{p_2}$$

$$(13) \qquad C_{T2} = \frac{(1-\alpha)(1+i^*)}{1+(1-\alpha)(1+\delta)} \frac{\tilde{W}}{e_2}.$$

The household's optimization problem is discussed in greater detail in Appendix I. It should be emphasized that the form of these demand equations (obtained from the log-linear utility function) are very special. They insure that the income and substitution effects of all cross-price effects just net to zero, except in the case of the rationed good where a change in p_1 has only a (negative) income effect, no substitution effect, as long as the $\bar{C}_{n1}$ constraint is binding. Second, they insure that changes in the quantity constraint $\bar{C}_{n1}$ have only a (negative) income effect and no "cross-quantity

substitution effect." (See Cuddington-Johansson-Lofgren (1984, p. 73ff) for a detailed discussion of effective demand function in the general case). These complications render virtually all comparative statics results indeterminant, as is well-known from the earlier literature on the elasticities approach to devaluation as well as the new intertemporal optimization models (e.g. Svensson and Razin (1983)).

2.C. The Government Sector

To avoid being unduly taxonomic, we assume the government purchases only nontradeable goods, financing these purchases by (lump-sum) taxes, debt issues, or money creation. Furthermore, these purchases are assumed to have no direct effect on private demand (implying that they enter the household utility function in a separable way, if at all, and have no effect on private production decisions).

Government demand is assumed to take priority over private-sector demands in the classical unemployment situation where, by definition, notional supply falls short of total private and government demand. Other rationing rules could, of course, produce different conclusions. A priori, the one we have chosen seems reasonable and is the standard one in the macro disequilibrium literature.

Like the private sector, the government is bound by the cash-in-advance constraint that characterizes our monetary economy:

$$(14) \qquad p_t \, g_t \leq M_t^g \quad ; \qquad t = 1, 2$$

where g_t is government demand for nontradeables and M_t^g is the amount of money the government requires to carry out such purchases. Equation (14) holds with

equality if the government holds no excess money balances, which would clearly be inefficient if the interest rate on nonmonetary assets is positive.

At the beginning of period t, the government receives money from taxes levied at the end of the previous period (T_{t-1}). In addition, the government has the authority to print new money (X_t) or to engage in net new borrowing ($B^g_t - B^g_{t-1}$) in order to obtain the transactions balances required to carry out its spending program. The government's financial transactions constraint, therefore, equals:

$$(15) \qquad M^g_t \leq T_{t-1} + X_t + e_t B^g_t - (1 + i^*_{t-1})\, e_t B^g_{t-1} \; ; \quad t = 1, 2.$$

Equation (15) holds with strict equality if there is no superfluous borrowing. In what follows, it is assumed that the initial stock of government bonds outstanding is zero ($B^g_0 = 0$) and that all government debt is fully repaid at the end of the second period. When (14) and (15) hold with strict equality (as efficiency requires), the following intertemporal government budget constraint emerges:

$$(16) \qquad p_1 g_1 + \frac{p_2 g_2}{1+i^*} = (T_0 + \frac{T_1}{1+i^*}) + (X_1 + \frac{X_2}{1+i^*}).$$

2.D. Foreign Sector

Given the assumption of an "S system" described above, foreign demand for domestic money (M^F_t) must be at least as great as the value of foreign spending on domestically-produced tradeable goods (C^F_{Tt}):

$$(17) \qquad e_t C^F_{Tt} \leq M^F_t \qquad t = 1, 2$$

3. Market Equilibrium

A. Domestic Money Market

Under the S-system (and assuming positive interest rates on nonmonetary assets), aggregate demand for domestic money (by domestic and foreign households and the domestic government) just equals the value of domestic output. This reflects the quantity theory of money with the restrictive unitary velocity of circulation that is inherent in the cash-in-advance specification. Equating domestic money supply and money demand in each period ($t = 0,1,2$) yields the monetary equilibrium conditions:

$$(18) \qquad \frac{M_o}{p_o} = Y_{no} + \rho_o Y_{To}$$

$$(19) \qquad \frac{M_0 + X_1}{p_1} = Y_{n1} + \rho_1 Y_{T1}(\rho_1)$$

$$(20) \qquad \frac{M_0 + X_1 + X_2}{p_2} = Y_{n2}(\rho_2) + \rho_2 Y_{T2}(\rho_2)$$

where the nontradeables price has been used as the numeraire. Equation (18) is included to indicate the amount of money that firms pay to households at the beginning of period 1 when our analysis of the economy begins; it is just a simple initialization for the model.

B. Nontradeable Sector

In the first period where p_1 and w_1 are assumed to be fixed and classical unemployment prevails, the level of output in the nontradeable sector is supply determined (via (1)). Assuming that the government sector gets priority in demand over the private sector, the rationed level of

nontradeables available for households (denoted by a bar over C_{n1}) equals:

$$(21) \qquad \bar{C}_{n1} = Y_{n1}(w_1/p_1) - g_1.$$

In the second period, Walrasian equilibrium is assumed to prevail. Wages adjust to clear the labor market, which can be suppressed here because labor supply is exogenous. The real exchange rate ρ_2 adjusts to clear the nontradeables market:

$$(22) \qquad Y_{n2}(\rho_2) = C_{n2} + g_2 = \alpha \frac{1+i^*}{1+(1-\alpha)(1+\delta)} \left[\frac{\tilde{W}}{p_2}\right] + g_2.$$

The explicit form of the household's effective demand for C_{n2} shown in (22), depends on residual wealth $\tilde{W}$ (defined above) and reflects the fact that households are rationed in the nontradeables market in the first period.

C. The Balance of Trade

Recall that the domestic economy is assumed to be small in the world market for tradeable goods. Hence, the balance of trade [14/] in periods 1 and 2 can be found using the standard definition:

$$(23) \qquad BT_1 = Y_{T1} - C_{T1} = Y_{T1}(\rho_1) - (1-\alpha) \frac{1+\delta}{1+(1-\alpha)(1+\delta)} \left[\frac{\tilde{W}}{e_1}\right]$$

$$(24) \qquad BT_2 = Y_{T2} - C_{T2} = Y_{T2}(\rho_2) - (1-\alpha) \frac{1+i^*}{1+(1-\alpha)(1+\delta)} \left[\frac{\tilde{W}}{e_2}\right].$$

where C_{T1} and C_{T2} are the household's effective demands. It is easy to show that the sum of the equilibrium values of the trade balance in the two periods must have a present value of zero:

$$(25) \qquad BT_1 + \frac{1}{1 + i^*} BT_2 = 0.$$

This is just the economy-wide intertemporal budget constraint.

D. Solving the Model

The endogenous variables of the model include ρ_1, ρ_2, e_1, e_2, p_2, $\bar{C}_{n1}$, BT_1, and $\tilde{W}$ (among others); the exogenous variables are: i^*, w_1, p_1, g_1, g_2, M_0, X_1, X_2, and T_1. (T_2 must, therefore, be endogenously determined so as to satisfy the government's intertemporal budget constraint in (16).) Our solution strategy involves collapsing the system to a simpler one where the current and future real exchange rates (ρ_1,ρ_2) are the crucial endogenous variables. This approach facilitates a diagrammatic presentation as well as an intuitive understanding of how the model works.

First, it should be noted that, because w_1 and p_1 are fixed, the real exchange rate ρ_1 (and hence national income) is recursively determined by the money market equilibrium condition for period 1 (equation (19)). This equilibrium level of ρ_1 is indicated by the MM locus in Figure 1. Fiscal expenditures cannot affect current income, only the severity of rationing inflicted on the private sector (via (21)), as long as they are not money-financed. 15/ Increases in g_1 that are tax or bond financed have no effect on the MM locus. (Increases in X_1 in the money-finance case shift MM upward.)

The second step is to get an expression for residual wealth $\tilde{W}$ that depends on ρ_1 and ρ_2 in order to solve the rest of the model. Given the specific form of our utility and effective demand functions, this is a particularly simple task: substitute the expressions for BT_1 and BT_2 from (23) and (24) into the economy-wide budget constraint (25) and solve for $\tilde{W}$:

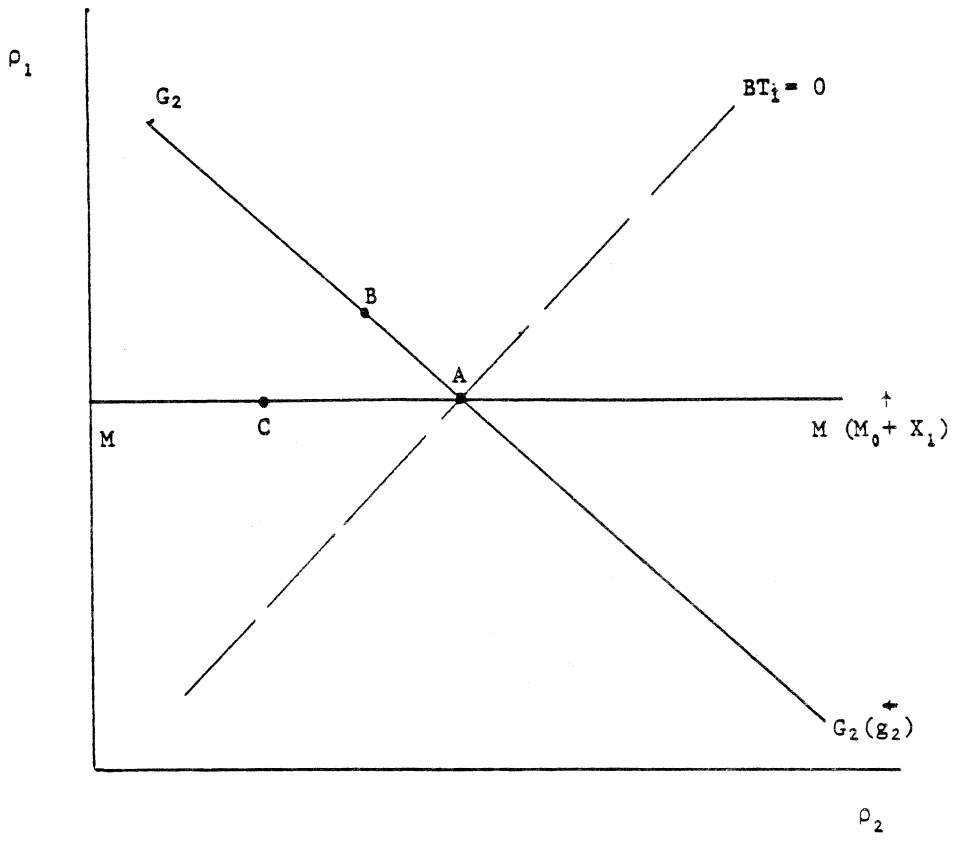

Figure 1: THE PERFECT FORESIGHT EQUILIBRIUM UNDER CLASSICAL UNEMPLOYMENT

$$(26) \qquad \tilde{W} \equiv W_0 - p_1\bar{C}_{n1} = e_1 \cdot \frac{1 + (1 - \alpha)(1 + \delta)}{(1 - \alpha)(2 + \delta)} [Y_{T1}(\rho_1) + \frac{1}{1 + i^*} Y_{T2}(\rho_2)].$$

Intuitively, private wealth rises whenever the current or future real exchange rate rises because, in either case, this brings about increased production of tradeable goods. This expression for residual wealth can now be substituted into the effective demand functions (11) - (13). The future-period nontradeables equilibrium in (18) can now be written as a function of two endogenous variables (ρ_1, ρ_2):

$$(27) \qquad Y_{n2}(\rho_2) = \alpha \frac{1 + i^*}{1 + (1 - \alpha)(1 + \delta)} \rho_2 [Y_{T1}(\rho_1) + \frac{1}{1 + i^*} Y_{T2}(\rho_2)] + g_2.$$

Equation (27) implicitly defines a <u>perfect foresight</u> function for ρ_2 conditional on ρ_1, which is determined recursively in (19) above:

$$(28) \qquad \tilde{\rho}_2 = \tilde{\rho}_2(\rho_1, g_2)$$

where $\tilde{\partial}\rho_2/\partial\rho_1 < 0$ and $\tilde{\partial}\rho_2/\partial g_2 < 0$. Intuitively, increases in ρ_1 drive up residual wealth (see (26) and the accompanying discussion) and hence the demand for all nonrationed goods. As the demand for nontradeables in period 2 rises, their price must rise (i.e. ρ_2 must fall) in order to restore nontradeables market equilibrium. The locus of (ρ_1, ρ_2) combinations that satisfies the nontradeables equilibrium condition in period 2 (equation (27) or (28)) is shown as G_2G_2 in Figure 1.

The intersection of MM and G_2G_2 in Figure 1, of course, reflects the equilibrium levels of the current and future real exchange rates. Once

these key endogenous variables have been determined, all others are recursively determined from the remaining equations. (Equation (20), for example, determines the future price p_2 because our model exhibits the classical dichotomy property in the long run, but not in the short run where w_1 and p_1 are fixed).

Our primary interest is in the balance of trade. Substituting residual wealth (26) into the expression for the trade balance in (23) yields:

$$(29) \qquad BT_1 = \frac{1}{2+\delta}\left[Y_{T1}(\overset{+}{\rho_1}) - \frac{1+\delta}{1+i^*} Y_{T2}(\overset{+}{\rho_2})\right]$$

The trade balance depends positively on the current real exchange rate and negatively on the future real exchange rate ceteris paribus. From (28), however, we know that ρ_2 depends on ρ_1 and g_2. Thus, increases in ρ_1 increase BT_1 directly as well as indirectly via the negative effect on ρ_2 as the economy moves along the G_2G_2 locus.

To complete our geometric representation of the model, it is useful to include iso-trade-balance curves in Figure 1, indicating (ρ_1, ρ_2) combinations that leave the trade balance unchanged. One such curve, $BT_1 = 0$, is shown in the Figure. We also indicate how changes in policy variables shift the MM and G_2G_2 curves in the Figure. It is clear from equation (19) on which the MM locus is based that increases in the money supply in period 1 cause the real exchange rate to depreciate, shifting MM upwards. Current-period government expenditure g_1, on the other hand, has no effect. As equation (28) indicates, however, precisely the opposite is true for the G_2G_2 locus. Increases in the future money supply X_2 have no effect on the G_2G_2 locus; anticipated increases in future government spending cause G_2G_2 to

shift leftward because the future real exchange rate must appreciate ceteris paribus to clear the nontradeables market in period 2.

4. Fiscal Policy and the Current Account

The model's two-period set-up permits us to compare the effects of current but temporary changes in government spending on nontradeables ($dg_1 > 0$, $dg_2 = 0$) and the announcement (today) of future changes in government spending ($dg_1 = 0$, $dg_2 > 0$). The effects of permanent changes (i.e. those initiated today and expected to continue in the future) can then be obtained by summing the results of temporary and future changes of equal magnitude ($dg_1 = dg_2 > 0$).

The effects of these fiscal shocks are quite striking, in part because of their initial lack of intuitive appeal for those used to ad hoc Keynesian unemployment models. For example, it is shown below that a temporary increase in government spending on nontradeables has no effect on the current account when it is tax financed (or, equivalently, bond financed), but it causes the current account to improve when it is money financed. Currently-announced increases in future government spending, on the other hand, cause the current account to improve today regardless of the method of finance. Finally, permanent increases in government spending also lead to improvements, not deteriorations, in the current account for economies with classical unemployment.

A. Temporary Tax-Financed Increases in Government Spending

Increases in government spending on nontradeables financed by taxation (or, equivalently, debt creation) have no effect on the real exchange rate in period 1. The real exchange rate ρ_1 is determined solely by the money market equilibrium condition (19), which is unaffected by changes in

g_1. [16/] Hence, the MM locus in Figure 1 does not shift.

Given our particular specification, it can be shown that temporary tax-financed increases in government spending have no effect on the expected future real exchange rate ρ_2 either. This can be seen mathematically by examining the expression for the G_2G_2 locus in (27). Because g_1 does not affect MM or G_2G_2, the equilibrium values of ρ_1 and ρ_2 remain unchanged. Hence, a temporary tax-financed increase in government spending on nontradeables has no effect on the current account. [17/]

The explanation for the foregoing result is the following. Under classical unemployment, the current output of nontradeables is supply-determined (via (1)), and hence is unaffected by changes in g_1. Changes in g_1 merely cause dollar for dollar crowding out of private demand for nontradeables. Next, one must next ask whether the residual wealth $(W_o - p_1\bar{C}_{n1})$ that households have to spend on C_{T1}, C_{n2} and C_{T2} -- after purchasing their rationed quantity of current-period nontradeables -- is affected by increased government spending, as this could affect the equilibrium values of ρ_2 and the current account. Substituting (16) into the household's intertemporal budget constraint in (9) - (10), it can be seen that W_o falls by exactly the amount as the increase in government spending. The amount of private spending on the rationed good, however, also falls when the government purchases a greater share of the available supply. Substituting (21) into the definition of residual wealth, it can be confirmed that these two factors offset each other so that residual wealth remains unchanged. Hence there is no shift in the demand for nontradeables in period 2, implying that ρ_2 remain unchanged, and no shift in the demand for tradeables in period 1, so the current account is unaffected.

B. Temporary Money-Financed Increases in Government Spending

In the case of a temporary money-financed increase in government expenditure, the current exchange rate ρ_1 must depreciate if the money market is to remain in equilibrium. To restore rational expectations equilibrium in the nontradeables market in the second period as ρ_1 rises, the expected future real exchange rate ρ_2 must appreciate. This is reflected by an upward shift in the MM locus along an unchanged G_2G_2 curve. Thus, a tilt in the intertemporal profile of relative prices has occurred: the real exchange rate depreciates today but is expected to appreciate in the future. From (29) it is easy to see that both of these price movements contribute to an improvement in the current account today. This is also clear from the Figure, where the new equilibrium at point B lies to the left of the initial iso-trade-balance locus BT=0 (indicating BT > 0).

To provide some intuition for the foregoing result, recall that the household's commodity demand functions depend on residual wealth, which in turn depends on the current and future levels of tradeables output as shown in (26). When the current real exchange rate depreciates and the future rate appreciates, the time profile of tradeables output changes. Current output rises, while future output falls. From (24) we can see that this time profile mimics the time profile of private disposable income (in equilibrium). The consumption smoothing inherent in the permanent income theory implies that the rise in current income relative to future income will increase saving today. Hence, the current account must improve in the short run.

Our conclusion that a temporary money-financed increase in government spending causes the current account to improve is exactly the opposite of the prediction obtained from standard models (referenced above). The usual pre-

sumption based on these models that expansionary fiscal policy will worsen the current account does not survive in a rigorous, microtheoretic specification of the classical unemployment regime.

C. Expected Increases in Future Government Spending

Expected increases in future government spending are also interesting in the classical unemployment context. An increase in government demand for nontradeables in period 2, which is announced in period 1, causes the rational expectations level of the future real exchange rate ρ_2 to fall ceteris paribus in order to clear the future nontradeables market. That is, the G_2G_2 curve shifts leftward in Figure 1. Money market equilibrium in the first period (19) is not affected by future government spending, so the current value of the real exchange rate remains unchanged; i.e., the MM locus does not shift. The equilibrating movement in prices is, therefore, a fall in the future real exchange rate but no change in its current value, as the economy moves to point C in Figure 1. The expectation that tradeable goods will be relatively cheaper in the future drives down the expected future output of tradeables. Because future output of tradeables (and hence household's future income) falls while current output (and income) remains constant, households reduce current consumption and increase saving. This reduction in private absorption causes a trade surplus today followed by a deficit in the future.

It is noteworthy that this implication of our model, namely that expected future increases in government spending cause the current account to improve today, does not depend on the method of finance. This is due to the assumptions that: (1) taxes are lump-sum in our model, and (2) the velocity of circulation is fixed at unity in the cash-in-advance specification of money demand. Consequently, changes in the inflation tax have no effect on household

behavior; they are, in effect, lump sum taxes also. Interestingly enough, therefore, the Ricardian equivalence (between taxes and bond financing) extends to the monetized portion of the debt if the monetization occurs during the Walrasian equilibrium period (t=2 in our model) where the classical dichotomy holds.

The foregoing results are summarized in Table 1. The last two rows in the Table consider the case of a permanent increase in government spending ($dg_1=dg_2>0$) under tax and money financing, respectively. Since this case is a simple combination of the two experiments discussed above, it needs little additional explanation. It is noteworthy, however, that a permanent increase in government spending always improves the current account. This is true regardless of the method of financing. Futhermore, it does not depend on the relationship between the rate of time preference and the world interest rate, which lead to the ambiguous current account effects derived in the inter-temporal optimization models where continuous full employment is assumed (referenced above).

V. Conclusions and Comparison with Alternative Models

Our model provides a useful benchmark when analyzing the relationship between fiscal policy and the current account in economies experiencing classical unemployment in the short run, even though wages and prices gravitate towards Walrasian equilibrium levels in the long run. It can usefully be compared to two alternative types of models: (1) the standard open-economy macromodels with rational expectations and wage-price rigidity and (2) the new Walrasian intertemporal equilibrium models of the current account which assume complete wage-price flexibility. From our results, the following interesting comparisons emerge:

Table 1: EFFECTS OF FISCAL POLICY

	dBT_1	dp_1	dp_2	dY_{n1}	dY_{T1}	dY_{n2}	dY_{T2}
Temporary Increases in Government Spending							
$dg_1 = dT_1$ (tax-financed)	0	0	0	0	0	0	0
$dg_1 = dX_1$ (money-financed)	+	+	-	-	+	+	-
Expected Future Increases in Government Spending*							
$dg_2 = dT_2 = dX_2$	+	0	-	0	0	+	-
Permanent Increases in Government Spending*							
$dg_1 = dT_1 = dg_2$ (tax-financed)	+	0	-	0	0	+	-
$dg_1 = dX_1 = dg_2$ (money-financed)	+	+	-	-	+	+	-

* The effects of changes in g_2 are the same regardless of whether they are financed by future taxes (dT_2) or future money creation (dX_2). See text for explanation.

1. The prediction of recent Walrasian intertemporal equilibrium models (referenced above) is that an expected future increase in government spending will improve the current account today. This is true regardless of the method of financing. It was shown above that this conclusion continues to hold in situations where the economy faces classical unemployment in the short run. This represents a significant generalization of the predictions of these new models of the current account.

2. The Walrasian intertemporal equilibrium models predict that temporary increases in government spending will cause the current account to deteriorate. Under classical unemployment, however, our model shows that a temporary increase in spending will either leave the current account unchanged or will actually improve it depending on whether it is tax (or equivalently debt) financed or money financed.

3. Macro rational-expectations models that incorporate the feature of short-run neoclassical unemployment predict a worsening of the current account following a permanent increase in government spending when it is tax or bond financed, and an ambiguous response when it is money financed. The Walrasian intertemporal equilibrium models, on the other hand, predict an ambiguous response, regardless of the method of financing. The predictions of our intertemporal optimizing model with classical unemployment are strikingly different. We show that the current account actually improves following a permanent increase in government spending, regardless of the method of financing, when the economy is suffering from short-run classical umemployment.

In our view, the framework developed is potentially useful for studying western European countries in the flexible exchange era. Admittedly,

however, further work remains to be done before the model is rich enough to permit direct empirical testing. In particular, the Ricardian equivalence assumption regarding debt versus tax finance of fiscal deficits should be relaxed -- either by introducing non-lump-sum taxes or an interest rate differential between the private and public sectors. The linking of wages to a cost of living index, the modelling of investment behavior, and a more general specification of the representative consumer's utility function and the restrictive cash-in-advance money demand functions would also be worthwhile. Our current research is exploring these extensions.

FOOTNOTES

1/ See, for example, Branson and Rotemberg (1981), Krugman (1982), Sachs (1979, 1983) and Gordon (1982) for empirical studies suggesting the importance of classical unemployment considerations in Europe in the last decade.

2/ Beginning from a situation of classical unemployment, a reduction in the real wage will increase employment until the economy moves to either: (1) the Walrasian equilibrium, (2) the border of the classical unemployment and repressed inflation regimes, or (3) the border between the classical and Keynesian unemployment regimes. (See Cuddington-Johansson-Lofgren (1984, p. 27) for a diagrammatic exposition.) In the latter case, there is infra-marginal Keynesian unemployment in the sense that a wage reduction must be accompanied by an increase in aggregate demand in order to move the economy (which initially has classical unemployment) to the full employment (Walrasian) equilibrium. (See the attached figure on the following page).

3/ See, however, Sachs (1980), Corden (1981), Pitchford (1981), Malinvaud (1982), Persson (1982) and van Wijnbergen (1984).

4/ See Branson and Buiter (1983) for a survey of the ad hoc rational expectations macro models of the current account with fixed or flexible wages and prices.

5/ See also Buiter (1984) and Giovanni (1984).

6/ Because the labor supply decision is exogenous in our model, it is unnecessary to form expectations regarding future wages.

7/ What is important is not the currency of invoice but the ultimate currency in which the suppliers want to receive payment. Furthermore, in what follows it does not matter whether it is the buyer or seller that enters the foreign exchange market in order to meet this demand for a specific currency required by the seller.

8/ An alternative specification is the "B-system" where the sellers require that all transactions be paid for using the buyer's home currency. See Helpman and Razin (1981) for a comparison.

9/ Implicitly, labor market transactions are credit transactions, which do not require cash-in-advance.

10/ The careful reader will note here that the length of one payment cycle in the cash-in-advance specification is presumably much shorter than the length of the periods defined earlier as the "short run" and the "long run" on the basis of whether wage-price flexibility does or does not prevail. It would be more precise, but would leave our conclusions unaffected, to assume that a large but fixed number of payment cycles

occurred in each of the two periods, the short run and the long run. The short run would then contain a number of identical fix-price equilibrium payment cycles. The long run would contain a number of identical Walrasian equilibrium payment cycles.

11/ This is the definition of classical unemployment used by Malinvaud (1977) in his taxonomy of disequilibrium regimes. Other papers (e.g. Persson (1982) and van Wijnbergen (1984)) consider models where the nominal wage is fixed but the prices of goods continuously adjust to market clearing levels. This situation, which has been called Orthodox Keynesian Unemployment (because it is at the boundary between Malinvaud's classical and Keynesian unemployment regimes), is not considered in this paper so as to avoid being unduly taxonomic. The Keynesian unemployment case is presented in Cuddington-Vinals (1984).

12/ As Persson (1982 fn.8) notes, "The careful reader might wonder why the household would work at all in the second and last period when there is no opportunity of spending the income. This problem is a consequence of the simplified two-period structure; it disappears in an infinite horizon framework."

13/ It is worth emphasizing that this specification builds the strong implications of Barro-Ricardian equivalence (i.e. debt neutrality) into models of the sort considered in this paper. See Appendix I for details.

14/ Because the economy's initial holdings of foreign assets equal zero, the balance of trade and the current account are the same in the first period.

15/ A referee notes that this is reminiscent of the Mundell-Fleming model. The money market alone determines income in that model because, as in ours, the current period price of nontradeables (or exportables in the M-F model) is fixed. Current income depends uniquely on p_1 in our model, so the analogy is exact. The result is also, it might be noted, a generalization of Malinvaud's (1977) finding that fiscal policy has no effect on income in a closed-economy, single-sector framework (where endogenous exchange rate changes, of course, play no role).

16/ This recursivity holds for the classical unemployment case but not in the Keynesian unemployment case, which is more difficult to characterize. See Cuddington-Vinals (1984).

17/ It should be noted that this result depends on our time-separable log-linear utility function. Using a general specification of two-period utility (but ignoring monetary considerations), van Wijnbergen (1984) finds that the effect of temporary government spending on the current account may be either positive or negative.

REFERENCES

Branson, William H. and Julio Rotemberg (1980), "International Adjustment With Wage Rigidity," European Economic Review, Vol. 13, No. 3, pp. 309-332.

Branson, William H. and Willem H. Buiter (1983), "Monetary and Fiscal Policy under Flexible Exchange Rates," in Jagdeep S. Bhandari and Bluford H. Putnam (eds.) Economic Interdependence and Flexible Exchange Rates, MIT Press.

Buiter, Willem H. (1984), "Fiscal Policy in Open Interdependent Economies," NBER Working Paper No. 1429 (September).

Corden, W. Max (1981), "Taxation, Real Wage Rigidity and Employment," Economic Journal, June, pp. 309-330.

Cuddington, John T., Per Olov Johansson and Karl Gustaf Lofgren (1984), Disequilibrium Macroeconomics in Open Economies, Oxford: Basil Blackwell.

Cuddington, John T. and Jose M. Viñals (1984), "Budget Deficits and the Current Account: An Intertemporal Disequilibrium Approach," Stanford University, Mimeo, April.

Dornbusch, Rudiger (1983). "Real Interest Rates, Home Goods and Optimal External Borrowing," Journal of Political Economy 91 (Feb.), 141-153.

Giovanni, Alberto (1984), "Fiscal Policy, the Capital Stock, and the Exchange Rate," Columbia University, mimeo.

Gordon, Robert J. (1982), "Why U.S. Wage and Employment Behavior Differs From That in Britain and Japan?," The Economic Journal, March, pp. 13-44.

Frenkel, Jacob A. and Assaf Razin (1984a). "Fiscal Policies, Debt, and International Interdependence," NBER Working Paper No. 1266.

Frenkel, Jacob A. and Assaf Razin (1984b). "Budget Deficits and Rates of Interest in the World Economy." University of Chicago, mimeo.

Helpman, Elhanan (1981), "An Exploration in the Theory of Exchange-Rate Regimes," Journal of Political Economy, Vol. 89, No. 5, pp. 865-890.

_____ and Assaf Razin (1981), "The Role of Saving and Investment in Exchange Rate Determination Under Alternative Monetary Mechanisms," Institute for International Economic Studies, Seminar Paper No. 181, October.

Krugman, Paul (1982), "The Real Wage Gap and Employment," Annales de L'Insee, No. 47-48, pp. 51-69.

Lucas, Robert E. (1982), "Interest Rates and Currency Prices in a Two-Country World," Journal of Monetary Economics, 10, pp. 335-359.

Malinvaud, Edmond (1977), The Theory of Unemployment Reconsidered. Oxford: Basil Blackwell.

Malinvaud, Edmond (1982), "Wages and Unemployment," The Economic Journal, March, pp. 1-12.

Neary, J. Peter and Joseph E. Stiglitz (1983), Towards a Reconstruction of Keynesian Economics: Expectations and Constrained Equilibria," Quarterly Journal of Economics 98 (Supplement), 199-228.

Obstfeld, Maurice (1980). "Intermediate Imports, the Terms of Trade, and The Dynamics of the Exchange Rate and The Current Account," Journal of International Economics 10, 461-480.

OECD (1983), Public Sector Deficits: Problems and Policy Implications, OECD Occasional Studies, June.

Penati, Alessandro (1983), "Expansionary Fiscal Policy and the Exchange Rate", IMF Staff Papers, October pp. 542-569.

Persson, Torsten (1982), "Global Effects of National Stabilization Policies Under Fixed and Floating Exchange Rates," Scandinavian Journal of Economics, 84 (2), pp. 165-192.

Pitchford, J.D. (1981), "Taxation, Real Wage Rigidity and Employment: The Flexible Price Case," The Economic Journal, September, pp. 716-720.

Razin, Assaf and Lars E. O. Svensson (1983), "The Current Account and the Optimal Government Debt," Journal of International Money and Finance, 2, pp. 215-224.

Sachs, Jeffrey D. (1979), "Wages, Profits and Macroeconomic Adjustment: A Comparative Study," Brookings Papers on Economic Activity. No. 2, pp. 269-319.

_____. (1980), "Wages, Flexible Exchange Rates and Macroeconomic Policy," Quarterly Journal of Economics, June, pp. 731-797.

_____. (1982), "Current Account in the Macroeconomic Adjustment Process" Scandinavian Journal of Economics, pp. 147-159.

_____. (1983), "Real Wages and Unemployment in the OECD Countries," Brookings Papers on Economic Activity, 1983:1, pp. 255-289.

Svensson, Lars E. O. and Assaf Razin (1983), "The Terms of Trade and the Current Account: The Harberger-Laursen-Metzler Effect," Journal of Political Economy, 91, 1, pp. 97-125.

van Wijnbergen, Sweder (1984). "Government Deficits, Private Investment, Employment and the Current Account under Different Employment Regimes. an Intertemporal Disequilibrium Analysis," Mimeo, DRD, World Bank.

TECHNICAL APPENDICES FOR: Cuddington-Viñals (1984), "Budget Deficits and The Current Account in the Presence of Classical Unemployment"

Appendix I

Derivation of the Households Intertemporal Budget Constraint in Equilibrium

Substituting (6) and (7) into (8) yields:

$$(A1.1) \quad p_1 C_{nt} + e_t C_{Tt} \leq p_{t-1} Y_{n,\,t-1} + e_{t-1} Y_{T,t-1} - T_{t-1} - \left(1 + i^*_{t-1}\right) e_t B_{t-1} + e_t B_t .$$

By adding-up present values over time and assuming that the weak inequalities hold as strict equalities, we get the household's intertemporal budget constraint for our two-period model (t = 0,1,2):

$$(A1.2) \quad p_1 C_{n1} + e_1 C_{T1} + \frac{p_2}{1 + i^*} C_{n2} + \frac{e_2}{1 + i^*} C_{T2} = W_0$$

where:

$$(A1.3) \quad W_0 = p_0 Y_{no} + e_0 Y_{T0} + \frac{1}{1 + i^*}\left(p_1 Y_{n1} + e_1 Y_{T1} - T_1\right)$$

The government's intertemporal budget constraint in (16) can now be used to rewrite (A1.3) as:

$$(A1.4) \quad W_0 = \left(p_0 Y_0 + e_0 Y_{T0} + X_1 - p_1 g_1\right) + \frac{1}{1 + i^*}\left(p_1 Y_{n1} + e_1 Y_{T1} + X_2 - p_2 g_2\right).$$

From (A1.4) it is clear that our model will exhibit debt neutrality, i.e. Ricardian equivalence between tax and bond finance of government spending.

Recalling the monetary equilbrium conditions (18)-(20), (A1.4) can be rewritten in terms of national income at t= 1 and t= 2 (rather than t= 0 and t= 1):

$$(A1.5) \quad W_o = (M_o + X_1 - p_1 g_1) + \frac{1}{1+i^*}(M_1 + X_2 - p_2 g_2)$$

$$= (p_1 Y_{n1} + e_1 Y_{T1} - p_1 g_1) + \frac{1}{1+i^*}(p_2 Y_{n2} + e_2 Y_{T2} - p_2 g_2)$$

$$= (p_1 (Y_{n1} - g_1) + e_1 Y_{T1}) + \frac{1}{1+i^*}(p_2 (Y_{n2} - g_2) + e_2 Y_{T2}).$$

Thus, household wealth is just the present value of national output net of government demand.

The household's problem of maximizing utility subject to the cash-in-advance constraints (6) and (7), and the financial constraint (8), therefore, reduces to the standard problem of choosing a (C_{nt}, C_{Tt}) sequence that maximizes (5) subject to the intertemporal budget constraint found by equating the present value of spending in (A1.2) to wealth in (A1.5). Once the equilibrium intertemporal profile of consumption has been obtained, the household's demands for domestic and foreign monies are determined recursively from (6) and (7). This recursivety between the real and monetary aspects of the household's utility maximization problem was first noted by Helpman (1981). Compare his final equations to our budget constraint when rewritten in "real" terms:

$$(A1.6) \quad C_{n1} + \rho_1 C_{T1} + \frac{1}{1+\gamma}(C_{n2} + \rho_2 C_{T2})$$

$$= y_{n1} - g_1 + \rho_1 Y_{T1} + \frac{1}{1+\gamma}(y_{n2} - g_2 + \rho_2 Y_{T2}) = \frac{Wo}{p_1}$$

where $1/(1+\gamma)$ is the real interest factor defined by $1/(1+\gamma) = p_2/(1+i^*)p_1$. This form of the budget constraint is not used in the text because it introduces another endogenous variable γ, which would subsequently be eliminated in solving the model in the way described in the text.

Appendix II

The Household Optimization Problem: The Demand for Goods and Money

The log-linear, time-separable form of the utility function coupled with the cash-in-advance specification of money demand allows the solution of the household intertemporal optimization problem to proceed in the following stages:

1. In stage one, the household decides how much expenditure it is optimal to make in each period.
2. In stage two, the household optimally allocates the previously selected expenditure between tradeables and nontradeables, subject to any quantity constraint it faces in the nontradeables market in the first period.
3. The household then decides how much domestic and foreign money it is necessary to hold to buy the chosen quantities of tradeables and nontradeables at prevailing prices.

As shown in Appendix I, in equilibrium, the household optimization problem reduces to:

$$\text{(A2.1)} \quad \max \; V = [\alpha \ln C_{n1} + (1 - \alpha) \ln C_{T1}] + \frac{1}{1 + \delta} [\alpha \ln C_{n2} + (1 - \alpha) \ln C_{T2}$$

subject to:

$$\text{(A2.2)} \quad (p_1 C_{n1} + e_1 C_{T1}) + \frac{1}{1+i^*} (p_2 C_{n2} + e_2 C_{T2}) = W_0$$

where W_0 is as defined in expression (10) of the text and the short-run quantity constraint in (21):

$$(A2.3) \qquad C_{n1} \leq \bar{C}_{n1} = Y_{n1} - g_1 .$$

The Lagrangian is:

$$\max L = [\alpha \ln \bar{C}_{n1} + (1 - \alpha) \ln C_{T1}] + \frac{1}{1 + \delta} [\alpha \ln C_{n2} + (1 - \alpha) \ln C_{T2}]$$

$$-\theta \left[p_1 \bar{C}_{n1} + e_1 C_{T1} + \frac{1}{1 + i^*} (p_2 C_{n2} + e_2 C_{T2}) - W_0\right]$$

θ is the Lagrange multiplier corresponding to (A2.2). The quantity constraint (A2.3), which is always binding in the presence of classical unemployment, has been embedded in the Lagrangian function. The first order conditions can be rearranged to yield:

$$(A2.4) \qquad \frac{e_1 C_{T1}}{e_2 C_{T2}} = \frac{1 + \delta}{1+i^*}$$

$$(A2.5) \qquad \frac{e_2 C_{T2}}{p_2 C_{n2}} = \frac{1 - \alpha}{\alpha}$$

$$(A2.6) \qquad e_1 C_{T1} + \frac{1}{1+i^*} (p_2 C_{n2} + e_2 C_{T2}) = W_0 - p_1 \bar{C}_{n1} \equiv \tilde{W}$$

where $\tilde{W}$ is defined as <u>residual wealth</u>.

After substitution we obtain the following effective demand functions:

$$(A2.7) \qquad C_{T1} = (1 - \alpha)\left(\frac{1 + \delta}{1 + (1 - \alpha)(1 + \delta)}\right)\left[\frac{W_0 - p_1 \bar{C}_{n1}}{e_1}\right]$$

$$(A2.8) \qquad C_{n2} = \alpha\left(\frac{1 + i^*}{1 + (1 - \alpha)(1 + \delta)}\right)\left[\frac{W_0 - p_1 \bar{C}_{n1}}{p_2}\right]$$

$$(A2.9) \qquad C_{T2} = (1 - \alpha)\frac{1 + i^*}{1 + (1 - \alpha)(1 + \delta)}\left[\frac{W_0 - p_1 \bar{C}_{n1}}{e_2}\right].$$

In a perfect foresight equilibrium, the household's money demands (for domestic and foreign monies in each period) are readily obtained by substituting the above expressions (A2.7)-(A2.9) into (6) and (7) -- with strict equalities -- in the text.

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