Fiscal Policy and the Current Account: An Optimizing Model

Partha Sen
Partha Sen, Assistant Professor
Department of Economics

Fiscal Policy and the Current Account:
An Optimizing Model

Earlier versions of this paper were presented at the University of Michigan, University of Illinois, the Mid-West International Economic Group and the World Congress of the Econometric Society, Cambridge. I am especially grateful to David Aschauer, Alan Deardorff, Robert Driskill, Earl Grinols, John Laitner, J. David Richardson, Malcolm Robinson and Steve Turnovsky for comments.
ABSTRACT

This paper re-examines the relationship between increased government expenditure and the current account in an optimizing model with a variable rate of time preference. It is shown that current account surpluses emerge irrespective of whether the increased government expenditure is directed towards the traded good or the non-traded good.

Key Words: Fiscal Policy, Variable Time Preference, Non-traded goods, Current account.
I. INTRODUCTION

In recent years, practitioners of open economy macroeconomics has been re-examining the relationship between government expenditure, real interest rates and the current account of the balance of payments. On the one hand, we have the recent U.S. experience which seems to clearly indicate that expansionary fiscal policy (a high full-employment deficit) is accompanied by high real interest rates and a real appreciation (see, e.g., Branson, Fraga and Johnson 1983). On the other hand, Robert Barro's work (Barro (1986)) indicates that for the UK, at least, wars have not been periods of high nominal rates. There is some doubt whether during the seven-year war Britain ran current account deficits (see, e.g., Neal (1977), but see Ahmed (1986) for an analysis of the twentieth century evidence where deficits were observed).\(^1\)

The Mundell-Fleming model certainly predicts the covariation observed in the U.S. in the first half of the 1980's (see Branson and Buiter (1983) and Branson, Fraga and Johnson (1985) for rational expectations extensions). So does the uncertain lifetime model of Yaari (see Yaari (1965) and Blanchard (1985)).

In this paper, we analyze the effect of increases in government expenditure on traded and nontraded goods on the real interest rate and the real exchange rate (i.e., the relative price of the traded good in terms of the nontraded good).\(^2\) This is done in an optimizing model where the rate of time preference of the representative individual is variable as in Uzawa (1968) and Obstfeld (1981). In this framework, we can derive a target level of wealth which is impervious to wasteful government expenditure, so individuals save in response to an increase
in government expenditure (see Engel and Kletzer (1986) for a discussion of the similarities and dissimilarities between the Uzawa and Yaari models both of which give rise to a target level of wealth).

The increased government expenditure on nontraded goods here causes the stock of net foreign assets to rise and the real exchange rate to appreciate in the new long-run equilibrium. On impact the real interest rate falls but the current account goes into a surplus. The relative price of non-traded goods could rise or fall. If the increased expenditure is on traded goods then in the new long-run equilibrium all real variables other than the stock of foreign currency bonds are unchanged. Foreign bonds increase so that the increased government demand is exactly equal to the additional net interest income on bonds. The dynamics here is like the M-F case of fiscal policy directed towards importables.

This paper thus extends the results that we normally associate with the purchasing power parity (PPP) literature of a positive covariation between foreign assets and expansionary fiscal policy (see Kouri (1976), Obstfeld (1981) but also Turnovsky (1984) where this does not happen). But in our model this result is obtained even when there is real exchange rate and real interest rate dynamics.

The paper is organized as follows: Section II sets up the model. In section III, the effects of various policies are analyzed. Finally in section IV we state the conclusions and analyze the results and the related literature.

II. THE MODEL

Consider an economy where agents consume traded (indexed T) and non-traded goods (indexed H). They also hold two assets--domestic
money (nominal stock M) and a foreign currency denominated bond (f) which pays a fixed interest (i*).

The representative household seeks to maximize the following functional

$$W = \int_{0}^{\infty} Z(C_{Ht}, C_{Tt}, m_t) e^{-\Delta t} dt$$

(1)

where $C_{Ht}$ and $C_{Tt}$ are respectively the consumption of the non-traded and the traded goods at time $t$. $m_t$ is the level of real balances measured in terms of $H$ ($= \frac{M}{P_H}$ where $P_H$ is the price of the non-traded good). $\Delta_t$ is the discount factor at time $t$ and is given by

$$\Delta_t = \int_{0}^{t} \delta_s ds$$

where

$$\delta_s = \delta(Z_s)$$

and satisfies

$$\delta' > 0, \delta'' > 0, \delta-Z\delta' > 0.$$ (2)

$$Z'\delta''(Z) + Z''\delta'(Z) \leq 0$$ (3)

$\delta_s$ is the subjective (instantaneous) discount rate. In assuming (3), we are following Uzawa (1968), Obstfeld (1981) and Nairay (1984). (Findlay (1978) and Svensson and Razin (1983) have a discussion of what happens when $\delta' < 0$).

We shall assume a special form for $Z$—the logarithmic utility function

$$Z = \alpha_1 \log C_H + \alpha_2 \log C_T + \alpha_3 \log m$$ (4)
At any instant, the household allocates its disposable income between accumulation of real wealth and consumption, i.e.,

\[
\dot{a}_t = q_t + \tau_t + (i^* + \theta_t) \ell_t f_t - \pi_t m_t - C_{Ht} - e_t C_{Tt} \tag{5}
\]

where \( a \) is the level of real (financial) wealth, a dot over a variable denotes a time derivative, \( q \) is the household's income from production (taken to be exogenous by the household), \( \tau \) is the transfer from the government also taken as given, \( e = EP^*_t/P^*_H \) is the real exchange rate, where \( E \) is the nominal exchange rate, \( P^*_t \) the foreign currency price of the traded good assumed to be constant and equal to unity, \( \pi \) is the expected rate of increase of \( P^*_H \), \( \theta \) the expected rate of increase of \( e \) and \( i^* \) the (fixed) foreign (real) interest rate.

The first four terms on the right hand side of (5) represent the disposable income of the household taking into account capital gains \((\theta e f \text{ and } -\pi m)\).

Real wealth is the sum of real balances and the real value of foreign bonds in terms of \( H \)

\[
a_t = m_t + e_t f_t. \tag{6}
\]

The household faces an intertemporal budget constraint which prevents it from issuing debt to finance consumption and issuing more debt to pay interest on the initial debt. This takes the form:

\[
\int_0^\infty \exp(-i^* t) [C_{Ht} + C_{Tt} + (\tau_t + i^* + \theta_t) m_t] dt \leq a_0 + \int_0^\infty \exp(-i^* t) (q_t + \tau_t) dt \tag{7}
\]

This would constrain the household to follow paths where
\[ a_t + \int_t^\infty \exp(-i*(s-t))(q_s + \tau_s)ds \geq 0. \] (8)

The proof of this is a straightforward extension of that in Appendix B of Obstfeld (1981).

We can write the (current-value) Hamiltonian for the problem (1) subject to (5), (7) and initial wealth \( a_0 \) as

\[
\frac{Z(C_H,C_T,\tilde{m}) + \lambda[\tilde{q} + \tilde{\tau} + i* \tilde{\alpha} - (i* + \theta + \pi)\tilde{m} - C_T - \tilde{C}_H]}{\delta(Z(C_H,C_T,\tilde{m}))} \] (a)

where \( \lambda \) is the auxiliary variable. Notice that the constraint in equation (5) has been expressed in terms of the traded good (a tilde denotes a variable in terms of \( T \), e.g., \( \tilde{m} \equiv m/e \)). This is done for analytical convenience only.

The first order conditions are:

\[
(1 - \frac{\delta'}{\delta} (Z + \lambda\tilde{a})) \frac{a_1}{C_H} = \lambda/e \] (10)

\[
(1 - \frac{\delta'}{\delta} (Z + \lambda\tilde{a})) \frac{a_2}{C_T} = \lambda \] (11)

\[
(1 - \frac{\delta'}{\delta} (Z + \lambda\tilde{a})) \frac{a_3}{m} = (i* + \theta + \pi)\lambda/e \] (12)

(10)-(12) give us

\[
a_2\frac{C_H}{a_1C_T} = e \] (13)

\[
a_3\frac{C_H}{a_1m} = i* + \theta + \pi \] (14)

Equation (13) equates the ratio of marginal utilities of the two goods to their relative price. Equation (14) says that the marginal utility of money in terms of the non-traded good must equal the opportunity cost of holding money—the nominal interest rate.
In addition the co-state variable evolves according to
\[ \dot{\lambda} = \lambda(\delta - i^*). \]  
(15)

We also have to specify how \( q \) and \( \tau \) are determined. \( q \) is the value of output in terms of \( H \)
\[ q = Q_H + eQ_T \]  
(16)

\[ Q_H = Q_{H}(e) \quad Q_H, < 0 \]  
(17)

\[ Q_T = Q_{T}(e) \quad Q_T, > 0 \]  
(18)

Equations (17) and (18) are the output supply functions. \( \tau \) is determined by the consolidated government budget constraint
\[ \tau = \mu \pi - G \]  
(19)

The government varies \( \tau \) so that money supply grows at a rate \( \mu \) for a given government expenditure \( G \). An increase in \( G \) for a given \( \mu \) can be financed by higher \( \pi \) ("inflation tax") or lower \( \tau \) (lower transfers). The case of a lump-sum tax financed increase in \( G \) is obtained by setting \( \mu = 0 \). We also require the steady state nominal interest rate \( (i^* + \mu) \) to be positive.

Although we do not explicitly consider bond-financed deficits in this paper they are actually equivalent to the experiment being conducted. In a model such as this bond-financing and tax financing are equivalent since agents have infinite horizons and perfect foresight (but see Liviatan (1982) for a discussion and some possible qualifications).
The household takes the expected paths of nominal variables $P_H$ and $E$, $\{P_H t\}$ and $\{E_t\}$ as given and calculates $\{P_H t q_t\}$ and $\{P_H t r_t\}$. On the basis of these expectations solves the problem (9), which generates time paths for real balances and consumption which in the case of perfect foresight must be consistent with the actual paths of real balances and output. Note that for the non-traded goods market to clear at each instant we must have:

$$Q_H = C_H + G_H \tag{20}$$

where $G_H$ is the government demand for the non-traded good. In this paper government expenditure is assumed to be wasteful.6

With perfect foresight we have

$$\pi_t = \frac{P_{Ht}}{P_{Ht}} \tag{21}$$

$$\theta_t = \frac{E_t}{E_{t-1}} \tag{22}$$

We can get the time path of real balances as

$$m = (\mu - \pi)m = (i^* + \mu + \theta - (a_3 C_H / a_1 m))m \tag{23}$$

The rate of change of foreign bonds is given by the current account surplus

$$f = Q_T - C_T + i^* f - G_T \tag{24}$$

where $G_T$ is the government demand for traded goods.

We can get the final differential equation which shows how $e$ evolves over time. To do this, we first solve equations (5), (10) and (20) to get
\[ \lambda = \lambda(e,m,f) \]  
(25)

and then differentiate this expression with respect to time and use (15), (23) and (24) to obtain

\[ \dot{e} = \rho(e,m,f) \]  
(26)

We confine ourselves to an equilibrium path which converges to a steady state where \( e = m = F = 0 \).

Linearizing the system of differential equations (23), (24) and (26) around the steady state, we find, that the trace and the determinant of the matrix of coefficients are given by:

\[ \text{Tr} = (a_3 \lambda \alpha \lambda^{-1} (Q_0 e - Q_H) + (\alpha \delta' \alpha) + \alpha \lambda \bar{Q}_H (m)^{-1} + i^*)(\bar{m} \lambda + \bar{e} \lambda)^{-1} \]  
(27)

\[ \text{Det} = \alpha_3 \lambda \delta' i^* \bar{e} \left( -(Q_H' - C') e i^* + \alpha_3 Q_H' / \alpha \right) / \bar{m} (\bar{m} \lambda + \bar{e} \lambda)^{-1} \]  
(28)

(a bar over a variable denotes a long-run value)

Since there is one predetermined variable in our model, we require that there be exactly one stable root. A necessary and sufficient condition for this to happen from (27) and (28) is

\[ \bar{e} \lambda + \bar{m} \lambda > 0 \]  
(29)

We shall assume that (29) holds.

Barring anticipated future and temporary policy changes, the evolution of the economy can be described by the following first order system:

\[ e(t) = \bar{e} + (f_o - \bar{f}) x \exp \lambda t \]  
(30)
\[ m(t) = \bar{m} + (f_0 - f)y \exp \eta t \] (31)

\[ f(t) = \bar{f} + (f_0 - \bar{f}) \exp \eta t \] (32)

where \([x,y,1]'\) is the characteristic vector associated with the stable root of \(\eta\). Also from (24), we see that \(x < 0\).

III. THE EFFECT OF FISCAL POLICY

(a) Non-Traded Goods

Suppose now the government increased its purchase of non-traded goods by \(dG_H\) (for convenience set \(G_T = 0\)). This policy is unanticipated, immediately implemented and permanent—the third order dynamics prevents an examination of anticipated and/or temporary disturbances. The effect of this policy on the steady-state is analyzed first and the dynamics of the real exchange rate and the current account next.

The long-run equilibrium conditions are given by (33) to (37) below:

\[ \alpha_2 \bar{C}_H / \alpha_1 \bar{C}_T = \bar{e} \] (33)

\[ \alpha_3 \bar{C}_H / \alpha_1 \bar{m} = i^* + \mu \] (34)

\[ \delta(\bar{Z}) = i^* \] (35)

\[ \bar{C}_H + G_H = \bar{Q}_H \] (36)

\[ \bar{C}_T = \bar{Q}_T + i^* \bar{f} \] (37)

The long-run effect of an increase in \(G_H\) is as follows: \(e\) appreciates in response to excess demand for \(H\) but \(C_H\) is lower in the new steady state. But total utility from goods and money must be unchanged,
so \( C_T \) and/or \( m \) must rise. An increase in \( m \) would lower the marginal utility of money given that the numerator of (34) falls as \( C_H \) falls. So we cannot have an increase in \( m \). \( m \) declines and \( C_T \) rises. But with a lower \( e \), \( Q_T \) falls. Thus across steady states \( f \) rises.\(^7\)

This is shown in figure 1. At the initial long-run equilibrium the relative price of non-traded goods is given by the line \( E_0E_o \). At \( E_0E_o \), production takes place at \( P_o \) and consumption at \( C_o \) (assuming \( C_H = 0 \) initially) on indifference curve \( U_o \). The vertical distance \( C_oP_o \) is the steady state trade balance deficit (= interest service account surplus, since the current account is zero). In the new long-run equilibrium, the production point is \( P_1 \), but the government appropriates a part of the home goods output (= \( D_1P_1 \)), so the new consumption point is vertically above \( D_1 \). The new consumption point \( C_1 \) is on a higher indifference curve \( U_1 \) (because real balances are lower, utility from goods must rise). So the vertical distance \( C_1P_1 \) is greater than \( C_oP_o \) implying a higher net interest income. If \( C_oP_o \) was negative, i.e., the country was a debtor, then indebtedness falls in the new steady state.

What about the impact effect of the increase in \( C_H \)? We know the system is "driven" by one stable (real) root and therefore the current account must go into surplus immediately. But the impact effect on \( e \) is ambiguous. To see this look at (38) which is equation (24) with (13) substituted in

\[
\dot{f} = Q_T(e) - C_T(e,G) + if
\]

An increase in \( e \) would definitely make the current account go into surplus by increasing \( Q_T \), reducing \( C_T \). \( f \) is, of course, fixed in the
short run (see figure 2(a)). But the direct effect of $G$ is to improve the current account. This effect on consumption could be large enough so that an appreciation of the exchange rate takes place (figure 2(b)).

(b) Traded Goods

Now assume that the government directs additional expenditure towards the traded good ($dG_T > 0$). Assume $G_H = 0$ for convenience.

The long run equilibrium conditions (36) and (37) are modified now

$$C_H = Q_H$$

$$C_T = Q_T + i*\bar{f} - G_T$$

It is easily verified that government expenditure affects no real variables other than $\bar{f}$. $\bar{f}$ rises by an amount so that the additional interest income $i*\bar{f} = dG_T$. In figure 1 in the new steady state, we remain at $P_0$ and $C_0$ except that interest income rises by $C_0 I_0$ which is exactly equal to the additional taxes levied.

Turning to the dynamics, we find that the real exchange rate must depreciate to put the current account into surplus. The direct effect of $G_T$ is to create a deficit. So we have a jump depreciation, followed by appreciations. The real interest rate falls, consumption falls, lending increases.

IV. CONCLUSIONS

In this paper the effect of increased government expenditure (which is wasteful) on the variables of interest occurs because agents save to offset the lowering of utility that would otherwise have accompanied such a policy. This gives rise to a target level of wealth (or utility).
If the rate of time preference were a constant then the economy would jump straight to a new long run equilibrium without any transitional dynamics as in Dornbusch (1983) (this is true for an unanticipated permanent increase in expenditure which is immediately implemented).

The endogeneity of rate of time preference means that across long-run equilibria, utility is constant, if the foreign real interest rate is constant. Thus agents smooth long-run consumption and they respond to any shocks to this by changing current consumption and therefore the current account surplus.

For the case of government expenditure on traded goods, the impact effect on the real interest rates, and the real exchange rate current account in our model are all in the same direction as in the Mundell-Fleming model, when increased expenditure there is directed towards importables.

This symmetry in response to all government expenditure in our model is a consequence of individuals trying to maintain a given level of utility in the long-run. Any tax (or bond) financed government expenditure would potentially leave long-run utility lower, unless agents took steps to counter them. This they do by sharply reducing consumption in the short-run. They succeed in neutralizing the long run effects of increased government expenditure on traded goods but when such a policy is directed towards non-traded goods even in the long-run it has allocative effects.
FOOTNOTES

1 Ahmed's analysis assumes purchasing power parity so there is neither an explanation for the real interest rate nor the real exchange rate.

2 It is important to note that fiscal policy in a set-up as in Dornbusch (1983) or in the present paper has no stabilization role. Also note in the present analysis (and Dornbusch) the real exchange rate is identified as the relative price of the traded good in domestic currency in terms of the non-traded good but both goods are produced domestically. In the M-F model and the PPP literature the domestic economy produces one good. In the Keynesian set up the price of this good is set at home and in the PPP framework, its foreign currency price is set abroad.

3 Deflating nominal balances by a price index does not alter any of the results concerning the behavior of the real exchange rate, the real interest rate and the current account. The dynamics become very messy. These issues are analyzed in some notes available from the author.

4 $\lambda$ is the shadow price in terms of the foreign good. In terms of the home good we have

$$\lambda_H = \lambda_H (\delta - i^* - \theta)$$

where $\lambda_H$ is the co-state variable if we had a instead of $\tilde{a}$ in (9). Note that in view (8) the transversality condition $\lim_{t \to \infty} \lambda_t \tilde{a}_t = 0$ is satisfied.
5. Note we also have \( \frac{dQ_T}{dQ_H} = -1/e \), the usual static optimality condition for production.

6. The case when government expenditure enters the utility function of the consumers is analyzed in some notes available from the author. Very few clear-cut results are available here (see Obstfeld (1981) for a discussion of the difficulties even within a simple PPP model).

7. The comparative statics are given by

\[
\frac{de}{dG_H} = (\alpha_2 \overline{Q}_H + \overline{e}_1 \overline{m}^2) \overline{\alpha}_2 \alpha_3 / \Delta \overline{m} \overline{C}_T \alpha_1^2 < 0
\]

\[
\frac{df}{dC_H} = (\alpha_3 / \overline{C}_T \alpha_1^2 \overline{m}^2 \Delta) [\overline{e}_T + \overline{G}_T] + \alpha_1 (\alpha_3 \overline{m} + \alpha_1) + \alpha_2 \overline{Q}_T \overline{Q}_H > 0
\]

\[
\frac{dm}{dC_H} = \alpha_2 \overline{\alpha}_3 / \alpha_1 \Delta < 0
\]

where \( \Delta = \alpha_3 \overline{\alpha}_3 / \alpha_1 \overline{m} \{ (\alpha_2 \overline{Q}_H - \alpha_1 \overline{e}_T - \alpha_1 \overline{C}_T) \overline{Q}_H \overline{m} \overline{C}_T + \overline{G}_T - \overline{e}_3 \} \)

8. Just observe that \( (i*f - G_T) \) always occurs as a composite term.

9. The presence of real balances in the utility function is not crucial for the difference as can be checked by setting them to zero.


REFERENCES


Figure 1

Figure 2(a)