Seminar Paper No. 356

EFFECTS OF BUDGETARY POLICIES IN OPEN ECONOMIES:
THE ROLE OF INTERTEMPORAL CONSUMPTION SUBSTITUTION

by

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Seminar Papers are preliminary material circulated
to stimulate discussion and critical comment.

June, 1986

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ABSTRACT

An economy's optimal response to temporary and anticipated future changes in government spending is examined in the context of a two-country model which highlights the role of the elasticity of intertemporal consumption substitution (ICS). Special attention is devoted to the case in which both governments pursue identical policy measures. The qualitative effects of such measures on an economy's current account, its terms of trade (in a two-commodity world), and its real exchange and interest rate (in a world with non-traded goods) are shown to depend on the relationship between the domestic and the foreign elasticity of ICS.

The mechanism by which fiscal policy disturbances are transmitted internationally has been studied extensively over the last few years in the context of a new generation of open-economy macro models incorporating the notions of rational expectations and intertemporal budget constraints. In the context of these models, considerable attention has been devoted to the role of asymmetries between countries in determining the effects of fiscal changes in one economy on the world rate of interest and international capital flows.¹ However, the implications of asymmetries in terms of one parameter -- the elasticity of intertemporal consumption substitution -- which plays an absolutely crucial role in any model of intertemporal trade, have not been adequately treated in the literature.²

If output is exogenously given through time, any change in the time profile of one agent's consumption must be accompanied by precisely the opposite shift in the aggregate absorption pattern of all other economic agents. In a world economy characterized by free markets, this opposite shift is induced by movements in the real rates of interest, or the relative prices of present goods in terms of goods available for consumption at various dates in the future. For any given change in the time profile of government spending, the magnitude of the necessary adjustment in the rates of interest depends on preferences of agents, particularly their willingness to substitute consumption at one point in time for consumption at another. This willingness is measured by the elasticity of intertemporal consumption substitution (ICS).

The present paper studies the role of this elasticity in determining the effects of unanticipated temporary and anticipated future changes in government spending within a two-country model of a fully-integrated world economy. The basic model is presented in Section I. It is a simplified,

two-period, one-commodity version of that developed by Frenkel and Razin

(1985). At the same time it is a somewhat more general version in the sense that it allows the elasticity of ICS to differ from unity and to differ between countries.

Section II examines the real-interest-rate effects of temporary and anticipated future changes in domestic and foreign government spending. Section III studies the current-account implications of the same set of policies. It highlights the relationship between an economy's capacity to absorb disturbances to the time profile of the flow of goods available for private consumption and the effects of such disturbances on its current account. ~~The important role of the economy's elasticity of ICS is the focus~~ of our analysis.

Section IV discusses some extensions of the basic model. Three alternative scenarios are considered: 1) a world in which the supply of consumption goods is endogenously determined in each period, 2) a world in which the output of the home country is distinct from that of the foreign country, and 3) a world in which each economy produces a traded and a non-traded consumption good. Given the growing interest in the implications of international coordination of fiscal measures - and in light of the figures presented in Table 1, which indicate that changes in government spending have in fact been similar in the major industrial countries over the last few years - special attention is devoted to the case in which identical policies are pursued both at home and abroad. The qualitative effects of such policies on an economy's terms of trade in a two-commodity world, and on its real exchange rate and the consumption-based real rate of interest in a world with non-traded goods, are shown to depend on the relationship between the domestic and the foreign elasticity of ICS.

Finally, Section V concludes the paper by arguing that the recent experience of the U.S. economy (including a current-account deficit, an improvement in the terms of trade, an appreciation of the real exchange rate, and an increase in the consumption-based real rate of interest relative to the traded-goods rate) may be interpreted to reflect the optimal response of an economy with a relatively low elasticity of ICS to a common policy shock: a temporary increase in government spending both at home and abroad. This interpretation of the recent experience should be viewed as complementary to the usual one which rests on the presumption that the major policy shifts over the last few years have been specific to the U.S. economy. To the extent that countries differ in terms of preferences as well as policies, both interpretations contribute to our understanding of the international adjustment mechanism.

I. The Model

Let us suppose that the world economy is made up of a home country and a foreign country, each consisting of a representative household and a government. Time is divided into two periods. In each period t ($t = 1, 2$), the home country produces a given quantity X_t of a single perishable consumption good; the foreign economy produces X_t^* units of the same commodity. Out of these quantities, G_t and G_t^* units are collected at home and abroad in the form of lump-sum taxes and consumed by the nation's government.³ The remaining output is shared by the households of the two countries through fully-integrated international markets for both commodities and bonds.

In order to highlight the role of intertemporal consumption substitution, let us assume that residents of the two economies have tastes which are time separable and identical in all respects except for the degree

of concavity of the utility function. In particular, let us define the level of welfare of the representative household at home and abroad by

$$(1) \quad U(C_1, C_2) \equiv \frac{C_1^{1-\theta}}{1-\theta} + \frac{DC_2^{1-\theta}}{1-\theta},$$

$$(2) \quad U^*(C_1^*, C_2^*) \equiv \frac{C_1^{*1-\theta^*}}{1-\theta^*} + \frac{DC_2^{*1-\theta^*}}{1-\theta^*},$$

respectively. In (1) and (2), C_t and C_t^* denote household consumption in period t at home and abroad, D is the subjective discount factors (i.e., $D \equiv 1/(1 + \delta)$, where δ is the constant rate of time preference; it is assumed that δ is identical across countries), and the positive constants θ and θ^* measure the degree of concavity of the utility function of domestic and foreign residents, respectively. In the event that $\theta = \theta^* = 1$, the utility functions (1) - (2) take the logarithmic form: $U(\cdot, \cdot) = \sum_t D^{t-1} \log(C_t)$. The intertemporal budget constraints confronting domestic and foreign households are

$$(3) \quad C_1 + RC_2 \leq W \equiv X_1 - G_1 + R(X_2 - G_2),$$

and

$$(4) \quad C_1^* + RC_2^* \leq W^* \equiv X_1^* - G_1^* + R(X_2^* - G_2^*),$$

where W and W^* are the discounted net income streams of the two households, and R is the interest rate factor, or the relative price of future in terms of present goods (i.e., $R \equiv 1/(1 + r)$, where r is the real rate of interest in the world economy).

In maximizing (1) subject to (3), and (2) subject to (4), residents of the two economies will choose intertemporal patterns of consumption which satisfy

$$(5) \quad C_1/C_2 = (R/D)^{1/\theta} \quad \text{and} \quad C_1^*/C_2^* = (R/D)^{1/\theta^*}.$$

The sensitivity of a household's intertemporal consumption profile with respect to R is measured by the elasticity of ICS. In (5), this elasticity is shown to be $1/\theta$ at home and $1/\theta^*$ abroad.

Optimization requires that the intertemporal budget constraints (3) and (4) be satisfied with equality. Use of (5) along with these equations enables us to express

$$(6) \quad C_1 = m_1 W, \quad C_1^* = m_1^* W^*$$

$$(7) \quad C_2 = m_2 W, \quad C_2^* = m_2^* W^*$$

where m_t and m_t^* are the marginal (and average) propensities to consume out of wealth in period t at home and abroad.

$$(8) \quad m_1 \equiv \frac{(R/D)^{1/\theta}}{R + (R/D)^{1/\theta}}, \quad m_1^* \equiv \frac{(R/D)^{1/\theta^*}}{R + (R/D)^{1/\theta^*}},$$

$$(9) \quad m_2 \equiv \frac{1}{R+(R/D)^{1/\theta}}, \quad m_2^* \equiv \frac{1}{R+(R/D)^{1/\theta^*}}$$

Clearly, $m_1 + Rm_2 = 1$ and $m_1^* + Rm_2^* = 1$. For future reference, it is also useful to note that if $R = D$, $m_1 = m_1^* = m_2 = m_2^* = 1/(1 + R)$.

In equilibrium, the world supply of the single commodity is equal to the world demand in each period. Thus, in period 1

$$(10) \quad X_1 + X_1^* = m_1 W + m_1^* W^* + G_1 + G_1^*.$$

An analogous condition defines goods-market equilibrium in period 2. It could easily be shown, however, that this condition is redundant.⁴

Accordingly, in the analysis below we shall focus our attention on the market for goods in period 1.

II. Government Spending and the World Rate of Interest

Upon substituting the definitions of W , W^* , m_1 , and m_1^* into (10), we obtain an equation which relates the interest-rate factor, R , to the government spending parameters G_t and G_t^* . By taking the total differential of this relationship in the neighbourhood of the initial equilibrium [defined by $X_1 = X_2 \equiv \bar{X}$, $X_1^* = X_2^* \equiv \bar{X}^*$, $G_1 = G_2 \equiv \bar{G}$, $G_1^* = G_2^* \equiv \bar{G}^*$, so that initially $D = R$ and hence $m_1 = m_2 = m_1^* = m_2^* \equiv \bar{m} = 1/(1 + R)$], we obtain

$$(11) \quad dR = - \frac{R/\bar{m}}{\frac{\bar{W}}{\theta} + \frac{\bar{W}^*}{\theta^*}} (dG_1 + dG_1^*) + \frac{R/\bar{m}}{\frac{\bar{W}}{\theta} + \frac{\bar{W}^*}{\theta^*}} (dG_2 + dG_2^*)$$

Thus, as one would expect to find in a fully-integrated world economy (described by the initial conditions stated above), a given increase in period-1 (period-2) government spending lowers (raises) R by the same amount

regardless of whether the change in public expenditure occurs at home or abroad. Moreover, by setting $dG_1 = dG_2$ and $dG_1^* = dG_2^*$ in (11), one obtains the well-known result that permanent changes in G and G^* have no effect on the world rate of interest.⁵ Only temporary changes ($dG_1 \neq 0$, $dG_1^* \neq 0$, $dG_2 = dG_2^* = 0$) or anticipated future changes ($dG_1 = dG_1^* = 0$, $dG_2 \neq 0$, $dG_2^* \neq 0$) affect the relative price of present in terms of future goods.⁶

Equation (11) also shows that the proportional decline in R following a temporary increase in government spending is equal to the ratio of that increase to $(\bar{m}W/\theta) + (\bar{m}W^*/\theta^*)$. The latter is a weighted sum of private spending at home and abroad, the weights being the domestic and the foreign elasticity of ICS, $1/\theta$ and $1/\theta^*$, respectively. Thus, the greater the values of $1/\theta$ and $1/\theta^*$ (and hence the greater the sensitivity of the households' intertemporal consumption profiles to changes in R) the smaller the necessary adjustment in the relative price of present in terms of future goods in response to any given shift in the supply of present goods available for private consumption. Similarly, in the case of an increase in the level of anticipated future government spending, the magnitude of the increase in R is again inversely related to $1/\theta$ and $1/\theta^*$.

III. Current-Account Implications

The home country's current-account surplus in period 1 is given by the difference between its income and absorption.

$$(12) \quad S \equiv X_1 - m_1 W - G_1.$$

As shown in (3) and (8), both W and m_1 are functions of R . After substituting these relationships into (12), differentiating the resulting

expression, and using the solution for dR provided by (11), we obtain the following relationship between S and government spending at home and abroad.

$$(13) \quad dS = - (1 - \bar{m})(1 - \sigma)dG_1 + (1 - \bar{m})(1 - \sigma)dG_2 \\ + (1 - \bar{m})\sigma dG_1^* - (1 - \bar{m})\sigma dG_2^* ,$$

where σ defines the size of the home country (relative to the world economy) in terms of its ability to absorb disturbances to the supply of goods available for private consumption. That is

$$(14) \quad \sigma \equiv \frac{W/\theta}{(W/\theta) + (W^*/\theta^*)}, \quad 1-\sigma \equiv \frac{W^*/\theta^*}{(W/\theta) + (W^*/\theta^*)} .$$

In this sense, the size of a country is measured by the product of total expenditure (wealth) of the private sector and the elasticity of ICS. Thus it is not only total private spending in an economy, but also the sensitivity of the time profile of that spending to changes in the intertemporal terms of trade that determines how much of any given disturbance to the goods market is absorbed domestically and how much of it is absorbed by the foreign country. The larger the economy, the greater its capacity to absorb disturbances, regardless of whether they originate at home or abroad. Accordingly, in equation (13), as we consider increasingly higher values of σ in the interval from zero to unity, the current-account effect of any given change in government spending at home declines in absolute value from a maximum of $(1 - \bar{m})dG_t$ units of output (which is equal to the world excess demand for goods in period t created by the change in G_t at the original rate of interest) to a minimum of zero. At the same time, the current-account effect of a shift in foreign spending grows with σ from a minimum of zero to a maximum of $(1 - \bar{m})dG_t^*$ units of output, the latter being the total

excess demand for goods in period t arising from a change in foreign spending.

In terms of the sign of the current-account effect associated with a given policy, (13) reveals that an increase in either G_1 or G_2^* gives rise to a period-1 deficit for the home country, while an increase in G_1^* or G_2 gives rise to a surplus. These results confirm the popular notion that in order to eliminate the current-account deficit of the US economy, there must be either a cut in current government spending in the US or an expansion in the rest of the world. However, at a more subtle level, the results also reveal that perfect synchronization of fiscal policy measures across countries may not succeed in preserving current-account balance.

In demonstrating this, let us consider the current-account implications of a fully-coordinated temporary increase in government spending. To simplify the analysis, let us assume that government spending is initially the same fraction of GNP in each economy and identical across periods. A coordinated temporary fiscal expansion can then be defined as $dG_1/\bar{X} = dG_1^*/\bar{X}^* > 0$, and $dG_2 = dG_2^* = 0$. By introducing these relationships into (13), we observe that the effect of the policy on the current account of the home country is given by

$$(15) \quad \left. \frac{dS}{dG_1} \right|_{dG_1^* = \frac{\bar{X}^*}{\bar{X}} dG_1} = \frac{(1 - \bar{m})W^*}{(W/\theta) + (W^*/\theta^*)} \left(\frac{1}{\theta} - \frac{1}{\theta^*} \right),$$

where use was made of the fact that $W^*/\bar{X}^* = W/\bar{X}$.⁷ The expression in (15) is equal to zero only if the elasticity of ICS is the same in the two economies. However, if $1/\theta \neq 1/\theta^*$, the internationally coordinated temporary increase in government spending entails a surplus (deficit) on the current account of the economy with the relatively more (less) elastic intertemporal

pattern of consumption. It can also be shown that a similarly coordinated increase in the level of anticipated future government spending generates a deficit (surplus) on the current account of the economy with the relatively higher (lower) elasticity of ICS.

IV. Further Extensions

This section considers three extensions of the basic model.

IV.A Intertemporal Production Substitution

The assumption that output is exogenous in each period may be relaxed in favor of a more general specification of the supply side. For example, if the possibility of investment offers the economy an opportunity to increase the supply (X_2) of goods available for household and government consumption in the second period at the expense of that available in the first period (X_1), we may define the intertemporal transformation functions of the two economies by

$$(16) \quad X_2 = f(X_1), \quad X_2^* = f^*(X_1^*)$$

where $f(\cdot)$ and $f^*(\cdot)$ are continuous, decreasing and strictly concave.⁸

In the event that production technology or the institutional framework governing investment decisions is not the same in the two countries, the elasticity of $f(\cdot)$ may differ from that of $f^*(\cdot)$ in the neighborhood of the initial equilibrium (i.e., the point on $f(\cdot)$ and on $f^*(\cdot)$ at which $f'(\cdot) = f^{*'}(\cdot) = -1/R$). Naturally, the economy with the relatively more elastic intertemporal transformation function exhibits a relatively greater supply response to changes in the world rate of interest in the same way that the economy with the relatively larger elasticity of ICS exhibits a relatively greater demand response. Since the current account reflects the gap between

the economy's supply and demand for goods in a given period, the current-account implications of being the economy with the relatively higher elasticity of ICS are very similar to those of being the economy with the relatively more elastic intertemporal transformation function.

IV.B Two-Commodity World

Another way of generalizing the model of Section I is by drawing a distinction between the domestic and the foreign good. This distinction introduces an important variable into the analysis: the commodity terms of trade. To get some flavor of the importance of the elasticity of ICS in this more general setting, let us consider the simplest possible two-commodity extension of our model. In particular, let the consumption index C_t in equation (1) take the form

$$(17) \quad C_t \equiv H_t^\alpha F_t^{1-\alpha}, \quad 0 < \alpha < 1,$$

where α is the (constant) share of domestically produced good (H), and $1-\alpha$ is that of the foreign good (F) in total expenditure of domestic residents. The foreign consumption index C_t^* is similarly defined, with an asterisk signifying foreign variables.

In order to highlight the role of intertemporal consumption substitution in determining the nature of the relationship between public expenditure and the terms of trade, let us suppose:

a) that the H-F composition of government spending in each economy is identical to that of the economy's household spending, b) that government spending is initially the same fraction of GNP in each economy and identical across periods, and c) that fiscal measures are internationally coordinated in the sense that an increase in government spending at home in period t is accompanied by an identical increase (as a percentage of GNP) abroad. A

~~temporary increase in government spending of this type can be shown~~

to worsen the current terms of trade of the economy with the relatively higher elasticity of ICS, provided the expenditure share of domestically-produced goods is larger at home than it is abroad.⁹

The following heuristic proof should suffice for present purposes. On the basis of the results presented in Section III, it should be clear that the country with the relatively higher elasticity of ICS develops a current-account surplus in response to a coordinated temporary fiscal expansion while the other economy develops a corresponding deficit. Thus, in the former economy, expenditure (private plus public) falls relative to income in the first period while it increases in the latter economy. If residents of each country have a relatively stronger preference for the locally-produced good, at the original terms of trade there emerges an excess supply in the first period of the good produced in the country with the higher elasticity of ICS and an excess demand for the good produced by the other country. Accordingly, the current terms of trade of the economy with the higher elasticity of ICS deteriorate. The same argument can be used to show that the future (period-2) terms of trade of this same economy necessarily improve.

If a similarly coordinated future increase in government spending is anticipated to occur, the terms-of-trade effects are exactly the opposite. For the economy with the relatively higher elasticity of ICS, the current (future) terms of trade improve (deteriorate).

IV.C Non-traded Goods

Finally, let us consider the version of our model in which H_t in equation (17) is interpreted to be the rate of consumption of an internationally non-traded good and F_t as the rate of consumption of a single traded commodity. In order to focus once again on the role of intertemporal

~~consumption substitution, let us suppose that, in addition to assumptions a)~~

and b) of the previous subsection, a concave, time-invariant production-possibilities frontier relates the output of traded to that of non-traded goods in each economy. It can then be shown that an internationally-coordinated (in the above sense) temporary increase in government spending raises the current and lowers the future relative price of traded in terms of non-traded goods in the economy with the higher elasticity of ICS. Because the economy with the higher elasticity is the one where expenditure falls relative to income in period 1 and rises relative to income in period 2, its real exchange rate - defined as the relative price of traded in terms of non-traded goods - must increase in the first period and fall in the second. Of course, the opposite real exchange rate movements manifest themselves in the economy with the relatively lower elasticity of ICS.

Similarly, anticipation of a coordinated future increase in government spending lowers (raises) the current relative price of traded in terms of non-traded goods in the economy with the relatively higher (lower) elasticity of ICS, while having the opposite effect on the country's period-2 real exchange rate.

The implications of these opposing real-exchange-rate movements for the consumption-based real rates of interest in the two economies are straightforward. For example, in case of a coordinated temporary increase in government spending, the consumption-based real rate is lower (higher) than the traded goods rate in the economy where the relative price of traded in terms of non-traded goods falls (rises) between periods, i.e., the economy with the higher (lower) elasticity of ICS.

V. Concluding Remarks

Most of the previous studies have tried to explain current-account fluctuations on the basis of models which highlight the distinction between domestic and foreign fiscal measures. However, as the data presented in Table 1 seems to indicate, changes in the time profile of government spending over the last few years have been quite similar across major industrial countries. To the extent that these changes are perceived to remain in effect for the same period of time (and to the extent that Ricardian equivalence holds), some of the recent developments may reflect asymmetric reactions of countries to a common set of policies rather than adjustment to policies implemented in just one of the countries.

In pursuing this line of investigation, we have found that the experience of the U.S. over the last few years (including a current-account deficit, an improvement in the terms of trade, a real exchange rate appreciation, and an increase in the consumption-based real rate of interest relative to the traded-goods rate) is very similar to that of an economy with a relatively low elasticity of ICS responding to a temporary increase in government spending both at home and abroad.

The problem of determining the effects of fiscal measures on a country's nominal exchange rate within the framework of the present model are left on the agenda for future research. It is interesting to note, however, that currency of the country with the relatively lower elasticity of ICS can easily be shown to appreciate in response to an internationally-coordinated temporary increase in government expenditure if a) demand for real balances in each economy is an increasing function of real household spending, and b) the rates of growth of the nominal money supply are identical across countries.

FOOTNOTES

*This paper was written while I was visiting the Institute for International Economic Studies in Stockholm. I would like to thank the Institute for the generous hospitality and the Social Sciences and Humanities Research Council of Canada for financial support. I am also grateful to Victor Argy, Jeremy Greenwood, Thorvaldur Gylfason, and Torsten Persson for useful conversations on the subject of this paper. Any of the remaining errors are, of course, mine.

1. See, for example, Aizenman (1983), Djajić (1985), Frenkel and Razin (1985, 1986a, 1986b), Greenwood and Kimbrough (1985), Persson (1985), and van Wijnbergen (1984). The recent paper by Marion and Svensson (1986) is of related interest.

2. In the context of small-country models, the importance of this elasticity is emphasized in the works of Dornbusch (1983), Obstfeld (1983, 1985), and Djajić (1986), among others.

3. The assumption that the public-sector budget is balanced in each period is made without any loss of generality. In a world such as the one analysed here, a switch from lump-sum tax to debt finance has no effect on the economy's current account nor on any of the variables of interest in the remainder of the paper. For further discussion of this "Ricardian equivalence" proposition, see Barro (1974).

4. It can be obtained by using eq. (10), the definitions of W and W^* in (3) and (4), and the fact that $m_1 + Rm_2 = 1$.

5. There would be an effect, of course, if we relaxed the assumption that δ is independent of the level of welfare enjoyed by the household. On this, see Obstfeld (1982) and Svensson and Razin (1983). There is also an interesting issue of whether one should assume that agents are able to insure themselves against unforeseen changes in fiscal policy. To the extent that

agents participate in such insurance markets, some of the conclusions of the present paper would be affected. For an analysis of this problem, see Stockman (1986).

6. Effects of exogenous changes in output can be examined to confirm the familiar result that $dR/dX_t = dR/dX_t^* = -dR/dG_t = -dR/dG_t^*$.

7. We know that $W/\bar{X} = (1 + R)[1 - \bar{G}/\bar{X}]$ and $W^*/\bar{X}^* = (1 + R)[1 - \bar{G}^*/\bar{X}^*]$ where $\bar{G}$ and $\bar{G}^*$ are the initial rates of government spending in the two economies over the two periods. Since $\bar{G}/\bar{X}$ was assumed equal to $\bar{G}^*/\bar{X}^*$, $W/\bar{X} = W^*/\bar{X}^*$.

8. See, for example, Bruce and Purvis (1985) and Sachs (1981) for a more extensive analysis of the role of investment in a similar setting.

9. If foreigners happen to have the relatively stronger preference for the good produced in the home country, the reverse is true.

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Table 1. Government Final Consumption as Percentage of GDP ^a

	1978	1979	1980	1981	1982	1983	1984
United States	17.7	17.6	18.3	18.2	19.2	19.3	18.8
Four major European Countries ^b	17.8	17.8	18.4	19.2	19.3	19.4	19.4
Total OECD <u>less</u> the United States	15.8	15.9	16.5	16.7	16.9	16.8	16.5

a Government final consumption expenditure mainly consists of current purchases of goods and services for public administration, defence, health and education. It excludes all transfer payments.

b Germany, France, United Kingdom and Italy.
Source of data: Table R6., OECD, Economic Outlook, December 1985