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Jeremy Greenwood

Kent P. Kimbrough

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Jeremy Greenwood

and

Kent P. Kimbrough

This paper contains preliminary findings from research work still in progress and should not be quoted without prior approval of the author.

DEPARTMENT OF ECONOMICS
UNIVERSITY OF WESTERN ONTARIO
LONDON, CANADA
N6A 5C2

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Jeremy Greenwood

University of Western Ontario

and

Kent P. Kimbrough

Duke University

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Abstract

From 1978-1982 slightly over three quarters of all IMF member countries had capital controls in any given year and a little under three quarters of all IMF member countries had capital controls every year. Since capital controls are so widespread and persistent, the international transmission process should be significantly affected by their presence. This paper uses an intertemporal utility maximization framework to look at the international transmission of fiscal policy. Several results emerge concerning the international transmission process under capital controls and the nature of comovements in macroeconomic aggregates such as output, employment, consumption, and investment. For instance, it is shown that movements in real interest rates will be negatively associated across countries under capital controls in contrast to the positive association which characterizes regimes allowing free capital flows. As a consequence, the intertemporal substitution effects occurring within countries serve to generate positive comovements in macroeconomic aggregates when capital flows are unrestricted, but when capital controls are present they serve to generate negative comovements. Some of the paper's other results concern the implications of capital controls for Ricardian equivalence, the role of financing decisions in the international transmission process under free and restricted capital movements, and the effect of capital controls on the magnitude of fiscal induced fluctuations throughout the world economy.

Jeremy Greenwood
Department of Economics
University of Western Ontario
London, Ontario N6A 5C2
Canada

Kent P. Kimbrough
Department of Economics
Duke University
Durham, NC 27706
U.S.A.

For quite some time now there has been considerable interest in the channels through which monetary and fiscal policies enacted in one country are transmitted to others. Policymakers are concerned with how the policies of their trading partners influence economic activity in their own country and with the proper response to these effects should they be deemed undesirable. During the 1970s most of the attention was focused on the international transmission of inflation and monetary policy [see, for instance, the papers in Darby et al. (1983)]. This was, of course, a consequence of the high rates of inflation experienced by several of the world's major industrial countries during this period. In contrast, the 1980s have, to this point, been a decade in which attention has focused on the international transmission of fiscal policy in general and budget deficits in particular.

For many years the standard references on the international transmission of monetary and fiscal policies were variants of Mundell (1968). However, the concern over U.S. budget deficits in the past few years has prompted renewed interest in the topic of fiscal policy and the international transmission process as exemplified by Persson (1982, 1983) and Frenkel and Razin (1984a,b). One element these papers have in common is the assumption that world capital markets are fully integrated in the sense that there are no impediments to international capital flows.

While capital markets have become more integrated in the past few years, impediments to international capital flows in the form of taxes and quantitative restrictions continue to be important, and are likely to remain so in the future. As Tables 1 and 2 illustrate, capital controls are highly prevalent in today's world economy. Of the seven major industrial countries listed in Table 1, four (France, Italy, Japan, and the United Kingdom) had capital controls (i.e., quantitative restrictions on capital flows) virtually

TABLE 1

CAPITAL CONTROLS IN SEVEN INDUSTRIAL COUNTRIES, 1966-1982

Country	Years Capital Controls in Place
Canada	none
France	1969-1982
Germany	none
Italy	1967-1982
Japan	1967-1979
United Kingdom	1967-1979
United States	none

Source: Entries are based on the summary tables at the back of the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions, 1967-1983 issues.

TABLE 2

CAPITAL CONTROLS IN IMF MEMBER COUNTRIES, 1978-1982

	% with capital controls		% with capital controls
all five years	72	1978	77
four years	3	1979	76
three years	3	1980	76
two years	1	1981	78
one year	2	1982	79
no years	19		

Source: Same as Table 1, 1979-1983 issues.

throughout the entire period from 1966-1982. This does not include taxes levied on international capital flows such as the U.S. Interest Equalization Tax that was in effect from 1963 to 1973, or less formal arrangements such as the Voluntary Foreign Credit Restraint Program the U.S. had from 1965-1974 for the purpose of protecting the U.S. balance of payments by limiting the acquisition of foreign assets. Table 1 suggests that not only are capital controls an important feature of the economic landscape, but that the major industrial countries can be divided into two groups -- those that regularly restrict access to world capital markets and those that allow much freer capital flows. Table 2 confirms this picture for all IMF member countries. Capital controls existed in 72% of these countries throughout the entire five-year period from 1978-1982, while 19% of these countries had no capital controls during that period. The figures in Table 2 further indicate that in recent years a bit more than three-quarters of all IMF members have typically had capital controls at any one time.

Given the prevalence of capital controls in the world economy, it is important to incorporate them rigorously into the discussion of the international transmission process. That is the purpose of this paper. Earlier work by Morgenstern (1959) on the international propagation of business cycles hints at the type of economic phenomena that the incorporation of capital controls into the discussion of the international transmission process may help to explain. Morgenstern used NBER reference cycle series for France, Germany, the United Kingdom, and the United States to compare the timing of business cycles during the periods 1879-1914 and 1919-1932. He found that prior to World War I the four countries were in the same phase (expansion or contraction) during 53.5% of all months, while during the interwar years the four countries were in the same phase only 35.6% of the time. Morgenstern

attributed the decline of the international business cycle during the interwar years to "the effects of World War I" (he is not very specific on what exactly he means by this), but he went on to argue that a key difference between the two periods that might account for his results was that autarchic policies, especially with respect to capital movements and currency convertibility, played a more prominent role during the interwar years than ever before. Although not conclusive evidence on the impact of capital controls on the international transmission process, Morgenstern's findings are provocative and they are indicative of the sorts of results one might hope for when blending capital controls into a discussion of the international transmission of fiscal policy as is done here.

The remainder of the paper is organized as follows. Section I outlines a two country intertemporal general equilibrium model under the assumption that world capital markets are fully integrated and capital movements unimpeded. The international transmission of fiscal policy is taken up in Section II, attention being focused on comovements in output, consumption, employment, investment, and welfare in the two countries. With this material as background Section III introduces capital controls (imposed by the home country) into the model. The fourth and fifth sections of the paper look at the international transmission of domestic and foreign fiscal policies in the presence of capital controls. Concluding remarks are presented in Section VI.

I. The Model

Before describing tastes and technology it will prove useful to say a few words about the role of government in the model. The world lasts for two periods, $t = 1, 2$, and domestic and foreign governments choose time profiles

for the level of government purchases of the single good that is produced and consumed worldwide. In addition to choosing the time profiles for government purchases $\{G^t\}_{t=1}^2$ and $\{G^{*t}\}_{t=1}^2$, financing decisions must also be made. Specifically, the individual governments must choose the time sequences of lump sum taxes, $\{\tau^t\}_{t=1}^2$ and $\{\tau^{*t}\}_{t=1}^2$, which they will levy on their citizens, with the difference between a nation's government spending and tax revenue being met by issuing or absorbing public debt. Government debt is a perfect substitute for privately issued debt. It is also assumed, here and in Section II, that world capital markets are fully integrated so that the domestic real interest rate, r, equals the foreign real interest rate, r^*. Following Barro (1981) government purchases are assumed to provide a composite of public services that enhance private sector production opportunities and substitute for private sector consumption, c^t and c^{*t}, with α^t and α^{*t} measuring the number of units of consumption to which a unit of government purchases is equivalent at home and abroad. This view of government purchases has recently been employed by Kimbrough (1983) and Aschauer and Greenwood (1984) to further examine the role of fiscal policy in open and closed economies.

A. Home Country Technology

The home country's output in period t, y^t, is given by the production function

$$y_t = f(\ell^t, k^t, G^t) \equiv w^t \ell^t + h(k^t, G^t) , \qquad (1)$$

where w^t is the marginal product of labor in period t, ℓ^t is employment in

period t, and k^t is the period t capital stock. The function $h(\cdot)$ satisfies the conditions $h_k, h_G > 0$; $h_{kk}, h_{GG} < 0$; and $h_{kG} \gtrless 0$ as capital and government purchases are complements or substitutes in the production process. (Subscripts denote derivatives so, for instance, $h_k \equiv \partial h / \partial k^t$.) The production function (1) has the virtue of allowing for possible complementarities between private sector inputs and government purchases while keeping the analysis of the labor market simple. The assumption of a constant marginal product of labor could easily be relaxed without altering any of the paper's main results.

The home country begins period one with no international indebtedness and an endowed capital stock k^1 which depreciates fully upon use. This means that the future capital stock, k^2 , is given by today's investment, I^1 . The investment decisions of the country's representative consumer-producer are aimed at maximizing wealth. Investment is thus dictated by the first-order condition $\delta h_k(I^1, G^2) = 1$, where δ is the discount factor $1/(1 + r)$. The home country's investment demand function is thus given by

$$I^1 = I(\delta, G^2) \; ; \quad I_\delta = - h_k / h_{kk} > 0 \quad \text{and} \quad I_G = - h_{kG} / h_{kk} \gtrless 0 \quad \text{as} \quad h_{kG} \gtrless 0 \; . \tag{2}$$

B. Home Country Preferences

Domestic agents maximize their lifetime utility, u , which depends positively on the flow of consumption services they receive, $c^t + \alpha^t G^t$, and negatively on the amount of labor they provide in each period of their lifetime. These preferences are characterized by the agent's expenditure function

$$E(1, \delta, w^1, \delta w^2, G^1, G^2, u) \equiv \min \{ c^1 + \delta c^2 - w^1 \ell^1 - \delta w^2 \ell^2 \,|\, G^1, G^2, u \} \tag{3}$$

which takes period one consumption as the numeraire. Use has also been made of the fact that in equilibrium real wages during the agent's lifetime are w^1 and w^2. The derivatives of the expenditure function with respect to its first four arguments give compensated consumption demand and labor supply functions of the following forms:

$$c^1 = c^1(\underset{(-)}{1}, \underset{(+)}{\delta}, \underset{(+)}{w^1}, \underset{(+)}{\delta w^2}, \underset{(-)}{G^1}, \underset{(+)}{u})$$

$$c^2 = c^2(\underset{(+)}{1}, \underset{(-)}{\delta}, \underset{(+)}{w^1}, \underset{(+)}{\delta w^2}, \underset{(-)}{G^2}, \underset{(+)}{u})$$

$$\ell^1 = \ell^1(\underset{(-)}{1}, \underset{(-)}{\delta}, \underset{(+)}{w^1}, \underset{(-)}{\delta w^2}, \underset{(-)}{u})$$

$$\ell^2 = \ell^2(\underset{(-)}{1}, \underset{(-)}{\delta}, \underset{(-)}{w^1}, \underset{(+)}{\delta w^2}, \underset{(-)}{u}) .$$

The sign under the argument in one of these supply or demand functions shows the sign, implied by the expenditure function (3), of the partial derivative of that function with respect to the argument in question. In signing the arguments in this system of compensated demand and supply functions it has been assumed that both gross substitutability and normality prevail. Also note that the expenditure function satisfies the conditions $E_{G1} = -\alpha^1$ and $E_{G2} = -\delta\alpha^2$. To see the intuition behind this, recall that government purchases substitute for private consumption at the rate α^t. Thus an increase in G^2, for example, allows agents to reduce their own expenditure on future consumption by $\delta\alpha^2$ in present value terms and still maintain their initial level of utility. Hence $E_{G2} = -\delta\alpha^2$. A similar explanation applies to E_{G1}. The substitutability of government purchases for private

consumption also implies $c^1_{G1} = -\alpha^1$ and $c^2_{G2} = -\alpha^2$. Finally, note the absence of G^1 in the functions $c^2(\cdot)$, $\ell^1(\cdot)$, and $\ell^2(\cdot)$ and of G^2 in $c^1(\cdot)$, $\ell^1(\cdot)$, and $\ell^2(\cdot)$.

C. Home Country Budget Constraints

Given the lump sum taxes levied by the domestic government, private sector decisions must satisfy the budget constraint

$$c^1 + \delta c^2 + I^1 = y^1 + \delta y^2 - \tau^1 - \delta\tau^2 . \tag{4}$$

The government's budget constraint implies that

$$G^1 = \tau^1 + D \quad \text{and} \quad G^2 + D/\delta = \tau^2 , \tag{5}$$

where $D = H + F$ is the government's first period budget deficit with H = domestic borrowing and F = foreign borrowing. Since world capital markets are fully integrated the composition of the government debt (domestic vs. foreign) is irrelevant.

Equation (5) can be used to substitute out for the tax terms in (4) to obtain

$$c^1 + \delta c^2 + I^1 + G^1 + \delta G^2 = y^1 + \delta y^2 . \tag{6}$$

Subtracting $w^1\ell^1 + \delta w^2\ell^2$ from both sides of (6) and using (1) - (3) yields

$$E(1,\delta,w^1,\delta w^2,G^1,G^2,u) + I(\delta,G^2) + G^1 + \delta G^2$$

$$= f(\ell^1,k^1,G^1) + \delta f(\ell^2,I(\delta,G^2),G^2) - w^1\ell^1 - \delta w^2\ell^2 \ . \tag{7}$$

The economy's overall resource constraint as given by (7) must be satisfied in equilibrium.

D. The Foreign Country

A set of conditions similar to those just outlined also holds for the foreign country. These conditions are listed as equations (1') - (7') below, where use is made of the fact that in equilibrium $\delta = \delta^* = 1/(1 + r^*)$.

$$y^{*t} = f^*(\ell^{*t},k^{*t},G^{*t}) \equiv w^{*t}\ell^{*t} + h^*(k^{*t},G^{*t}) \tag{1'}$$

$$I^{*1} = I^*(\delta,G^{*2}) \ ; \quad I^*_\delta = -h^*_k/h^*_{kk} > 0 \quad \text{and} \quad I^*_G = -h^*_{kG}/h^*_{kk} \gtrless 0 \ \text{ as } \ h^*_{kG} \gtrless 0 \tag{2'}$$

$$E^*(1,\delta,w^{*1},\delta w^{*2},G^*\ ,G^{*2},u^*) \equiv \min\{c^{*1} + \delta c^{*2} - w^{*1}\ell^{*1} - \delta w^{*2}\ell^{*2} \,|\, G^{*1},G^{*2},u^*\} \tag{3'}$$

$$c^{*1} + \delta c^{*2} + I^{*1} = y^{*1} + \delta y^{*2} - \tau^{*1} - \delta\tau^{*2} \tag{4'}$$

$$G^{*1} = \tau^{*1} + D^* \ , \quad G^{*2} + D^*/\delta = \tau^{*2} \tag{5'}$$

$$c^{*1} + \delta c^{*2} + I^{*1} + G^{*1} + \delta G^{*2} = y^{*1} + \delta y^{*2} \tag{6'}$$

$$E^*(1,\delta,w^{*1},\delta w^{*2},G^{*1},G^{*2},u^*) + I^*(\delta,G^{*2}) + G^{*1} + \delta G^{*2}$$

$$= f^*(\ell^{*1},k^{*1},G^{*1}) + \delta f^*(\ell^{*2},I^*(\delta,G^{*2}),G^{*2}) - w^{*1}\ell^{*1} - \delta w^{*2}\ell^{*2} \ . \tag{7'}$$

E. World Equilibrium

To close the model the goods market must clear in both periods. However, by Walras' Law one of these conditions is redundant, so only the first period market clearing condition is formally specified:

$$c^1(1,\delta,\delta w^2,G^1,u) + c^{*1}(1,\delta,w^{*1},\delta w^{*2},G^{*1},u^*) + I(\delta,G^2) + I^*(\delta,G^{*2}) + G^1 + G^{*1}$$

$$= w^1 \ell^1(1,\delta,w^1,\delta w^2,u) + h(k^1,G^1) + w^{*1}\ell^{*1}(1,\delta,w^{*1},\delta w^{*2},u^*) + h^*(k^{*1},G^{*2}) \; . \tag{8}$$

It is also useful to note that the home country's current account, b^1, is defined as

$$b^1 = c^1 + I^1 + G^1 - y^1 \; . \tag{9}$$

From (8) it follows that in equilibrium $b^1 + \delta b^2 = 0 = b^{*1} + \delta b^{*2}$.

II. Integrated Capital Markets and Fiscal Policy

To set the stage for an examination of the effects of changes in fiscal policy, totally differentiate (7) and (7') to obtain

$$E_u du = -(1 - \alpha^1 - h_G^1)dG^1 - \delta(1 - \alpha^2 - h_G^2)dG^2 + (b^1/\delta)d\delta \; , \tag{10}$$

$$E_u^* du^* = -(1 - \alpha^{*1} - h_G^{*1})dG^{*1} - \delta(1 - \alpha^{*2} - h_G^{*2})dG^{*2} - (b^1/\delta)d\delta \; . \tag{10'}$$

Home country welfare rises or falls with an increase in the discount factor (i.e., a fall in the real interest rate) as the home country runs a first period deficit or surplus on current account, and vice versa for the foreign country since $b^1 = -b^{*1}$. When capital controls are introduced in Section III it will be assumed a binding constraint is imposed on domestic private sector borrowing from abroad so, to facilitate comparison of results, it is assumed here that the home country is presently running a current account deficit ($b^1 > 0$). Hence home welfare improves and foreign welfare worsens when the real interest rate falls. Note that in the two country framework adopted here the size of the current account will play a more important role than in the typical small open economy. This is because movements in domestic variables, such as government purchases, may cause shifts in the world real interest rate which will in turn generate wealth effects that are proportional to the size of the current account balance.

The remaining terms in (10) and (10') reflect the impact of changes in government purchases on welfare given world real interest rates. For purposes of illustration, consider the effects of an increase in current domestic government purchases on home welfare. These purchases ultimately take an equal amount of resources out of the private sector's hands, thus reducing welfare by dG^1 (this is the present value of the extra tax liabilities now facing the private sector). However, the incremental government purchases provide consumption services and enhance private sector production opportunities and hence raise welfare by $(\alpha^1 + h_G^1)dG^1$, where $h_G^1 = h_G(k^1, G^1)$. The net effect is a change in domestic welfare equal to $-(1 - \alpha^1 - h_G^1)dG^1$. Following Barro (1981), Kimbrough (1983), and Aschauer and Greenwood (1984), it is assumed that government purchases engender negative wealth effects so

that $1 - \alpha^1 - h_G^1 > 0$, and similarly for the other government purchase coefficients in (10) and (10').[1]

The behavior of the real interest rate can be studied by totally differentiating the market clearing condition, (8), and using (10) and (10') in the resulting expression. This gives

$$-\Delta d\delta = (1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)dG^1 + [I_G - \delta(1 - \alpha^2 - h_G^2)(c_W^1 + y_W^1)]dG^2 \tag{11}$$

$$+ (1 - \alpha^{*1} - h_G^{*1})(1 - c_W^{*1} - y_W^{*1})dG^{*1} + [I_G^* - \delta(1 - \alpha^{*2} - h_G^{*2})(c_W^{*1} + y_W^{*1})]dG^* \ ,$$

where $c_W^1 = c_u^1/E_u$, $y_W^1 = -w^1 \ell_u^1/E_u$, the foreign marginal propensities c_W^{*1} and y_W^{*1} are similarly defined, and

$$\Delta = c_\delta^1 + w^2 c_{\delta w}^1 + c_\delta^{*1} + w^{*2} c_{\delta w}^1 + I_\delta + I_\delta^* - w^1(\ell_\delta^1 + w^2 \ell_{\delta w}^1)$$

$$- w^{*1}(\ell_\delta^{*1} + w^{*2} \ell_{\delta w}^{*1}) + (b^1/\delta)(c_W^1 + y_W^1 - c_W^{*1} - y_W^{*1}) \ .$$

The term Δ measures the magnitude of excess demand in the world goods market created by an increase in the world market discount factor, δ . It is assumed that $\Delta > 0$ which is equivalent to assuming that a fall in the world real interest rate (i.e., a rise in δ) causes an excess demand for goods on international markets. This assumption is in accord with the standard macroeconomic presumption that substitution effects dominate wealth effects and will be valid so long as the wealth effect term, $(b^1/\delta)(c_W^1 + y_W^1 - c_W^{*1} - y_W^{*1})$, is not negative and large. Also, a positive sign for Δ is required for the traditional stability criterion to be met.

Equations (10), (10'), and (11) can be used to find the effects of fiscal policy shifts on home and foreign welfare and the real interest rate. These results can then be used in conjunction with the model's other equations to describe the impact of fiscal policy shifts on output, consumption, employment, investment, and the current account. The fact that the government budget deficits, D and D^*, do not enter (10), (10'), or (11) highlights the fact that Ricardian equivalence, as discussed by Barro (1974), holds when capital markets are fully integrated. This means that it is the level and timing of government purchases, and not the method of financing them, that is important for the international transmission of fiscal policy.

A. Temporary Changes in Government Purchases

Consider a temporary increase in government purchases by the home country; $dG^1 > 0$, $dG^2 = 0$.[2] It can be seen from (11) that a temporary increase in government purchases creates an excess demand for goods (since domestic residents desire to cut their spending by only a fraction, $c_W^1 + y_W^1$, of the increase in government purchases) and therefore the real interest rate must rise (i.e., the discount factor must fall) to clear the market:

$$\frac{d\delta}{dG^1} = \frac{-(1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)}{\Delta} < 0 . \qquad (12)$$

As a consequence, domestic welfare is reduced not only because of the negative wealth effects associated with government purchases but also because of the deterioration in the home country's intertemporal terms of trade. This can be seen clearly from (10) and (12) which imply

$$\frac{du}{dG^1} = \frac{-(1 - \alpha^1 - h_G^1)}{E_u}\left[1 + \frac{(b^1/\delta)(1 - c_W^1 - y_W^1)}{\Delta}\right] < 0 . \qquad (13)$$

The effects of a temporary increase in home country government purchases on domestic consumption, employment, output and investment can be uncovered by differentiating the consumption demand, labor supply, production, and investment demand functions. This yields

$$\frac{dc^1}{dG^1} = (c_\delta^1 + w^2 c_{\delta w}^1)\frac{d\delta}{dG^1} + c_u^1 \frac{du}{dG^1} - \alpha^1 < 0 ,$$

$$\frac{d\ell^1}{dG^1} = (\ell_\delta^1 + w^2 \ell_{\delta w}^1)\frac{d\delta}{\delta G^1} + \ell_u^1 \frac{du}{dG^1} > 0 ,$$

$$\frac{dy^1}{dG^1} = w^1 \frac{d\ell^1}{dG^1} + h_G^1 > 0 ,$$

$$\frac{dI^1}{dG^1} = I_\delta \frac{d\delta}{dG^1} < 0 .$$

The substitution and wealth effects as well as the crowding out effect associated with a temporary rise in government purchases all work to reduce domestic consumption. Both substitution and wealth effects work to increase employment. Domestic output rises because of the expansion in employment and the direct productivity enhancing effects of government purchases. The rise in the real interest rate dampens domestic investment and capital formation.[3] The result that output and employment rise along with a decline in welfare is an example of what Persson (1982) has called an "immiserizing expansion," which essentially casts doubt on the preoccupation of policymakers with such macroeconomic aggregates.

Turning to the international transmission of this policy to the foreign country, note from (10') and (12) that

$$\frac{du^*}{dG^1} = \frac{-(b^1/\delta)}{E^*_u}\frac{d\delta}{dG^1} > 0 \ .$$

Foreign welfare improves because the intertemporal terms of trade move in its favor. Foreign macroeconomic aggregates can be seen to respond in the following manner to a temporary increase in home country government purchases:

$$\frac{dc^{*1}}{dG^1} = \left[c^*_\delta{}^1 + w^{*2}c^*_{\delta w}{}^1 - (b^1/\delta)c^*_w{}^1 \right]\frac{d\delta}{dG^1} < 0 \ ,$$

$$\frac{d\ell^{*1}}{dG^1} = \left[\ell^*_\delta{}^1 + w^{*2}\ell^*_{\delta w}{}^1 - (b^1/\delta)(\ell^*_u{}^1/E^*_u) \right]\frac{d\delta}{dG^1} > 0 \ ,$$

$$\frac{dy^{*1}}{dG^1} = w^{*1}\frac{d\ell^{*1}}{dG^1} > 0 \ ,$$

$$\frac{dI^{*1}}{dG^1} = I^*_\delta\frac{d\delta}{dG^1} < 0 \ .$$

The substitution effects triggered by the rise in the real interest rate work to reduce consumption and raise output and employment abroad. The wealth effects associated with this change in the intertemporal terms of trade work in the opposite direction. Assuming that substitution effects dominate wealth effects, foreign output and employment rise and consumption and investment fall in response to a temporary increase in home country government purchases. This assumption is adopted from here on out so as to provide a benchmark case with which to compare international transmission results under capital controls. Note that it is consistent with the goods market stability condition $\Delta > 0$. In addition, many commonly used preference structures, such as that employed by Frenkel and Razin (1984a), guarantee this result.

In light of these results it can be shown using (9) and $b^1 = -b^{*1}$ that

$$\frac{db^1}{dG^1} = -\left[c^{*1}_{\delta} + w^{*2}c^{*1}_{\delta w} + I^{*}_{\delta} - w^{*1}(\ell^{*1}_{\delta} + w^{*2}\ell^{*1}_{\delta w}) - (b^1/\delta)(c^{*1}_{w} + y^{*1}_{w}) \right]\frac{d\delta}{dG^1} > 0 .$$

That is, the home country's current account deteriorates as domestic residents try to smooth the negative wealth effects associated with the temporary rise in government purchases.

These results serve to highlight a fundamental aspect of the international transmission of fiscal policy when capital markets are fully integrated. The substitution effects arising from changes in the real interest rate triggered by shifts in fiscal policy work to generate positive comovements across countries in macroeconomic aggregates such as output, employment, consumption, and investment. That is, substitution effects act to make $Cov(y^1, y^{*1})$, $Cov(\ell^1, \ell^{*1})$, $Cov(c^1, c^{*1})$, $Cov(I^1, I^{*1}) > 0$. In contrast, the wealth effects associated with fiscal policy induced movements in the intertemporal terms of trade work to generate negative comovements in macroeconomic aggregates across countries. So long as wealth effects are not too strong, temporary changes in government purchases will result in positive comovements in output, employment, consumption, and investment.[4]

B. Permanent Changes in Government Purchases

Permanent changes in government purchases, $dG^1 = dG^2 = dG$, are treated only briefly here as the results are similar to those found elsewhere in the literature [see Greenwood (1983), Kimbrough (1983), and Frenkel and Razin (1984a,b)].

The impact of a permanent change in government purchases on the real interest rate can be found from (11) to be

$$\frac{d\delta}{dG} = \frac{-\left[\delta(1 - \alpha - h_G)(c_W^2 + y_W^2 - c_W^1 - y_W^1)\right] - I_G}{\Delta}, \qquad (14)$$

where $\alpha^1 = \alpha^2 = \alpha$ and $h_G^1 = h_G^2 = h_G$ have been assumed for simplicity, and use has been made of the fact that the budget constraint implies $c_W^1 + y_W^1 + \delta(c_W^2 + y_W^2) = 1$. The first term in the numerator of (14) describes how agents desire to distribute across time — at the initial real interest rate — the burden of increased government purchases. For instance, if agents' time profiles of consumption and leisure are upward sloping (at the margin) so that $c_W^2 + y_W^2 > c_W^1 + y_W^1$, individuals will desire to cut back consumption and leisure in the second period to a greater extent than in the first period in response to the welfare loss created by the increased government spending. This will tend to drive up the real interest rate, $r = (1/\delta) - 1$. The second term reflects the impact of changes in domestic investment which tend to raise or lower the real interest rate as capital and government purchases are complements or substitutes in the production process (i.e., as $h_{kG} \gtrless 0$). As a result of these forces, the real interest rate may rise, fall, or remain unchanged in the face of a permanent increase in government purchases.

Since it is through real interest rate fluctuations that fiscal policy shifts are transmitted internationally, the preceding discussion indicates that the foreign repurcussions of permanent changes in domestic government purchases hinge on (i) the tilt of consumption and leisure profiles (at the margin) and (ii) the technological relation between capital and the public services provided by government purchases. In the benchmark case where marginal propensities are constant across periods and the technological relation between capital and government purchases is weak ($h_{kG} = 0$) there will be no international transmission of permanent changes in government purchases.[5] It can

also be shown that, given these conditions, permanent changes in government purchases will not affect the current account ($db^1/dG = 0$). This highlights how the international transmission of fiscal policy is intertwined with its current account effects.

III. The Model with Capital Controls

Suppose now that the home country government institutes a system of capital controls that prevents the private sector from borrowing more than a certain amount, z, from abroad. If this constraint is binding, as will be assumed, the domestic real interest rate will exceed the world real interest rate because of the artificially induced scarcity of credit. The wedge between the two, $(1/\delta) - (1/\delta^*) = r - r^*$, can be viewed as government revenue obtained through the competitive sale of financial market licenses; revenue which accrues at the time loans are paid off. The government's second period revenue from capital controls is thus $[(1/\delta) - (1/\delta^*)]z$.

The imposition of capital controls modifies several of the conditions characterizing the world economy, especially those pertaining to the home country. Equations (1) - (4) continue to hold (and therefore the consumption demand and labor supply functions remain the same). However, the government's budget constraints are no longer given by (5) but by

$$G^1 = \tau^1 + H + F \quad \text{and} \quad G^1 + \frac{H}{\delta} + \frac{F}{\delta^*} = \tau^2 + (\frac{1}{\delta} - \frac{1}{\delta^*})z \ , \qquad (15)$$

where as before H and F represent public sector debt sales domestically and internationally.

From (15) it follows that the present value of private sector tax

liabilities is

$$\tau^1 + \delta\tau^2 = G^1 + \delta G^2 - (1 - \frac{\delta}{\delta^*})(z + F) \ .$$

Using this in (4), subtracting $w^1\ell^1 + \delta w^2\ell^2$ from both sides of the resulting expression, and using (1) - (3) gives the home country's overall resource constraint under capital controls:

$$\begin{aligned} &E(1,\delta,w^1,\delta w^2,G^1,G^2,u) + I(\delta,G^2) + G^1 + \delta G^2 \\ &= f(\ell^1,k^1,G^1) + \delta f(\ell^2,k^2,G^2) - w^1\ell^1 - \delta w^2\ell^2 + (1 - \frac{\delta}{\delta^*})(z + F) \ . \end{aligned} \tag{16}$$

Equation (16) replaces equation (7) and can be thought of as determining domestic utility, u, once the domestic and world discount factors, δ and δ^*, are determined. The term $(1 - \delta/\delta^*)(z + F) = (1 + r)^{-1}(r - r^*)(z + F)$ represents the present value of revenues earned by the government on the country's foreign borrowing -- that earned on private sector borrowing is explicit, via the sale of financial market licenses, while that earned on government borrowing from abroad is implicit. Essentially, with capital controls in place the government can be viewed as acting as an intermediary for the private sector on world capital markets. Since the private sector is fully cognizant of the government's budget constraint, they treat both the government's and their own borrowing as part of their international loan portfolio to which such intermediary services apply.

In order to pin down the domestic real interest rate the nature of capital controls must be formally specified. The constraint capital controls impose on the private sector's foreign borrowing is

$$z = c^1 + I^1 + H - (y^1 - \tau^1) .$$

The private sector spends its income on consumption, investment, and the acquisition of domestically marketed government debt. Any excess of these expenditures over disposable income, $y^1 - \tau^1$, is financed by borrowing from abroad. Using (15) to eliminate current period taxes from this expression yields

$$\begin{aligned} z + F = {} & c^1(1,\delta,w^1,\delta w^2,G^1,u) + I^1(\delta,G^2) + G^1 \\ & - w^1 \ell^1(1,\delta,w^1,\delta w^2,u) - h(k^1,G^1). \end{aligned} \tag{17}$$

Since both z and F are policy variables, $\tilde{b} = z + F$ can be viewed as the domestic government's target for the overall capital account. The domestic real interest rate, embodied in δ, adjusts so that the market clears and the capital account target is attained.

Several important features of capital controls are apparent from (16) and (17). First, relaxing capital controls and increasing public sector borrowing from abroad are equivalent policies. This can be seen by noting that z and F always enter together in (16) and (17). Thus what matters from the economy's point of view is not who borrows from abroad but the total amount of borrowing from abroad the country as a whole undertakes. Second, Ricardian equivalence between lump sum taxes and foreign borrowing by the government breaks down under capital controls. This is because by borrowing from abroad the government can effectively relax the economy's overall foreign borrowing constraint.[6] This is an example of a case discussed by Barro (1974) where

Ricardian equivalence fails to hold because the government is a more efficient intermediary than the private sector. The only difference is that here this comparative advantage arises from a policy-induced distortion whereas in Barro's discussion a "natural" cost advantage is involved. Third, Ricardian equivalence continues to hold between lump sum taxes and domestically issued public debt. This is for familiar reasons. Fourth, there is a distinction between government purchases financed by taxes or domestically issued public debt, what will be called domestically financed government purchases, and government purchases financed by foreign issues of public debt. That is, a switch from domestically to internationally financed government purchases will have real effects. These effects arise because of the role played by public sector borrowing in relaxing the economy's overall borrowing constraint.

Finally, modifications relating to the foreign economy must be dealt with. Equations (1') - (7') continue to hold with (7') in essence determining foreign utility, u^* . The only modification needed is that δ be replaced by δ^* since the two differ under capital controls. Equation (7') is accordingly modified and rewritten as

$$E^*(1,\delta^*,w^{*1},\delta^*w^{*2},G^{*1},G^{*2},u^*) + I^*(\delta,G^{*2}) + G^{*1} + G^{*2}$$

$$= f^*(\ell^{*1},k^{*1},G^{*1}) + \delta^* f^*(\ell^{*2},I^*(\delta^*,G^{*2}),G^{*2}) - w^{*1}\ell^{*1} - \delta^* w^{*2}\ell^{*2} \; . \tag{18}$$

In addition, the world real interest rate, reflected in δ^* , adjusts to clear the world goods market. However, since $z + F = c^1 + I^1 + G^1 - y^1$, this condition can be written as $z + F = y^{*1} - c^{*1} - I^{*1} - G^{*1}$, or using (1'), (2'), and the foreign consumption demand and labor supply functions as

$$z + F = w^{*1}\ell^{*1}(1, \delta^*, w^{*1}, \delta^* w^{*2}, u^*) + h^*(k^{*1}, G^{*1})$$

$$- c^{*1}(1, \delta^*, w^{*1}, \delta^* w^{*2}, G^{*1}, u^*) - I^*(\delta^*, G^{*2}) - G^{*1} \ . \tag{19}$$

IV. Capital Controls and Domestic Fiscal Policy

The preceding discussion suggests that under capital controls it is important to distinguish between shifts in domestic government purchases financed domestically and internatioally. In addition, changes in the method of financing a given level of government purchases may also be transmitted internationally whereas in the absence of capital controls financing decisions were irrelevant. Equations (16) - (19) provide the basis for a thorough examination of these issues.

Totally differentiating (16) - (19) and using the same procedure that was used earlier to derive (10), (10'), and (11) yields the following system of equations which form the backbone of the comparative statics results concerning fiscal policy:

$$E_u du = -(1 - \alpha^1 - h_G^1)dG^1 - \delta(1 - \alpha^2 - h_G^2)dG^2 + (1 - \frac{\delta}{\delta^*})d\tilde{b} + \frac{\delta\tilde{b}}{(\delta^*)^2} d\delta^* \ , \tag{20}$$

$$- A d\delta = (1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)dG^1 + [\, I_G - \delta(1 - \alpha^2 - h_G^2)(c_W^1 + y_W^1)\,]dG^2$$

$$+ (c_W^1 + y_W^1) \frac{\delta\tilde{b}}{(\delta^*)^2} d\delta^* - [\, 1 - (c_W^1 + y_W^1)(1 - \frac{\delta}{\delta^*})\,] d\tilde{b} \ , \tag{21}$$

$$E^*_u du^* = -(1 - \alpha^{*1} - h^{*1}_G)dG^{*1} - \delta^*(1 - \alpha^{*2} - h^{*2}_G)dG^{*2} - (\tilde{b}/\delta^*)d\delta^* \ , \quad (22)$$

$$\begin{aligned} -A^*d\delta^* = {} & (1 - \alpha^{*1} - h^{*1}_G)(1 - c^{*1}_W - y^{*1}_W)dG^{*1} \\ & + [\, I^*_G - \delta^*(1 - \alpha^{*2} - h^{*2}_G)(c^{*1}_W + y^{*1})\,]dG^{*2} + d\tilde{b} \ . \end{aligned} \quad (23)$$

Recall that $\tilde{b} = z + F$ is the home country's target overall capital account.

From (20) it can be seen that, as before, since the home country is a net borrower a fall in the world real interest rate (i.e., a rise in δ^*) improves domestic welfare. Relaxing the overall borrowing constraint, $\tilde{b}$, improves domestic welfare because of the capital market distortion $1 - \delta/\delta^* = (1 + r)^{-1}(r - r^*)$ introduced by capital controls. Note also that now domestic welfare is unaffected by movements in the domestic discount factor, δ. This reflects the fact that under capital controls borrowing and lending are, at the margin, "nontraded" activities.

In equation (21) the term $A = c^1_\delta + w^2 c^1_{\delta w} + I_\delta - w^1(\ell^1_\delta + w^2 \ell^1_{\delta w}) > 0$ measures the response of the home country's excess demand for current period goods to changes in the discount factor. A key implication of (21) is that all else equal $d\delta/d\delta^* < 0$. This implies, for instance, that a fall in the foreign real interest rate (i.e., a rise in δ^*) tends to raise the domestic real interest rate (i.e., to lower δ). That is, under capital controls foreign real interest rate movements are negatively transmitted to the domestic real interest rate. Put differently, capital controls will be characterized by negative comovements in intertemporal relative prices. This is a consequence of the manner in which capital controls affect the international

transmission of real interest rate movements; their quantitative nature creating markets that behave more like markets for nontraded goods than like internationally linked markets. For instance, a fall in world real interest rate represents an improvement in the home country's intertemporal terms of trade. Home country wealth rises, creating an incipient excess demand for goods and in order to clear the domestic market the domestic real interest rate must rise. This already points to a fundamental difference in the international transmission process under capital controls versus that under fully integrated capital markets. Earlier it was noted that in the latter case substitution effects worked to generate positive comovements across countries in macroeconomic aggregates. However, in the presence of capital controls just the opposite is true. The negative international transmission of intertemporal relative price fluctuations will, via intertemporal substitution effects, tend to generate negative comovements in macroeconomic aggregates. Negative international transmission of relative price movements seems to be a general feature of trade under quantitative restrictions; examples concerning intratemporal relative prices can be found in Greenwood and Kimbrough (1984) where (among other things) the impact of terms of trade changes under exchange controls is examined.

Regarding the foreign country equations, the welfare equation, (22), is the same as (10') from the earlier analysis. In (23) the term $A^* = c^{*1}_{\delta} + w^{*2}c^{*1}_{\delta w} + I^*_{\delta} - w^{*1}(\ell^{*1}_{\delta} + w^{*2}\ell^{*1}_{\delta w}) - (\tilde{b}/\delta^*)(c^{*1}_{W} + y^{*1}_{W}) = -d\tilde{b}/d\delta^*$ is the slope of the foreign supply curve (or offer curve) of loans facing the home country. Again, if the substitution effects from an interest rate change dominate the wealth effects then $A^* > 0$. Also, stability of the foreign goods market in the traditional sense requires that A^* be positive. [This assumption was implicit in Section II's discussion of the current account effects of a temporary

change in government purchases. Note that there $db^1/dG^1 = -A^*(d\delta/dG^1)$.]

A. Changes in the Method of Financing Government Purchases

Consider the international transmission of a switch in the home country government's financing arrangements. Suppose this switch entails a tax cut (or a reduction in domestic sales of public debt) coupled with a sale of public debt to foreigners that leaves the time profile of government purchases intact. Given the irrelevance of whether foreign borrowing is undertaken by the public or private sector, this policy is equivalent to an easing of capital controls.

From (22) and (23) it can be seen that this reshuffling of government financing will be transmitted to foreign real interest rates and welfare as follows:

$$\frac{d\delta^*}{d\tilde{b}} = \frac{-1}{A^*} < 0 \ , \tag{24a}$$

$$\frac{du^*}{d\tilde{b}} = \frac{-\tilde{b}}{E^*_u \delta^*} \frac{d\delta^*}{d\tilde{b}} > 0 \ . \tag{24b}$$

The switch of domestic government financing to foreign sources raises the demand for foreign goods (and credit) and raises world real interest rates which tend to be artificially depressed by home country capital controls. The improvement in its intertemporal terms of trade raises foreign welfare. The transmission of this domestic fiscal policy change to foreign macroeconomic aggregates is given by

$$\frac{dc^{*1}}{d\tilde{b}} = \left[c^{*1}_{\delta} + w^{*2} c^{*1}_{\delta w} - (\tilde{b}/\delta^*) c^{*1}_{W} \right] \frac{d\delta^*}{d\tilde{b}} < 0 \ , \tag{24c}$$

$$\frac{d\ell^{*1}}{d\tilde{b}} = \left[\ell^{*1}_{\delta} + w^{*2}\ell^{*1}_{\delta w} - (\tilde{b}/\delta^{*})(\ell^{*1}_{u}/E^{*}_{u}) \right] \frac{d\delta^{*}}{d\tilde{b}} > 0 \ , \tag{24d}$$

$$\frac{dy^{*1}}{d\tilde{b}} = w^{*1}\frac{d\ell^{*1}}{d\tilde{b}} > 0 \ , \tag{24e}$$

$$\frac{dI^{*1}}{d\tilde{b}} = I^{*}_{\delta}\frac{d\delta^{*}}{d\tilde{b}} < 0 \ , \tag{24f}$$

where the signs in (24c) - (24e) follow from the dominance of substitution effects over wealth effects. The increased domestic reliance on deficit financing through increased international sales of public debt has an expansionary impact on foreign output and employment while reducing foreign consumption and investment. Despite the reduction in current consumption and leisure, future consumption and leisure rise by enough that foreign welfare improves as shown by (24b). This example clearly illustrates that offsetting the effects of increased deficit financing by one's trading partners, something many countries seem concerned with, is not necessarily the same thing as welfare maximization — here foreign welfare rises precisely because increased domestic budget deficits are allowed to be transmitted internationally.

From (21) it can be seen that this policy is accompanied by a fall in the domestic real interest rate:

$$\frac{d\delta}{d\tilde{b}} = \frac{1 - (c^{1}_{W} + y^{1}_{W})(1 - \frac{\delta}{\delta^{*}})}{A} - \frac{c^{1}_{W} + y^{1}_{W}}{A}\frac{\delta\tilde{b}}{(\delta^{*})^{2}}\frac{d\delta^{*}}{d\tilde{b}} > 0 \ . \tag{25}$$

A switch from taxes to deficit financing thus exhibits the negative comovement in real interest rates that was suggested earlier to be a fundamental characteristic of capital controls. In this particular case the domestic real interest rate falls because of the effective loosening of capital controls

(first term)[7] and the negative wealth effects associated with the rise in the world real interest rate (second term).

The change in domestic welfare can be seen from (20) to be

$$\frac{du}{d\tilde{b}} = \frac{1}{E_u}\left[\left(1 - \frac{\delta}{\delta^*}\right) + \frac{\delta\tilde{b}}{(\delta^*)^2}\frac{d\delta^*}{d\tilde{b}}\right] \gtrless 0 .$$

Home welfare tends to improve because of the distortion related to international borrowing and the relaxation of capital controls implicit in the government's financing switch, but to fall due to the deterioration in the intertemporal terms of trade. This result can be clarified by relating it to whether or not the tax equivalent of the quantitative restriction implied by capital controls is above or below the optimum level. The term $d\delta^*/d\tilde{b} = -1/A^* < 0$ is the slope of the foreign offer curve. Letting $(\delta^*/\tilde{b})(d\tilde{b}/d\delta^*) = \eta^*$ be the elasticity of the foreign offer curve, it can be shown that

$$\frac{du}{d\tilde{b}} = \frac{\delta}{E_u}\left[\frac{1}{\delta} - \frac{1}{\delta^*}\left(1 - \frac{1}{\eta^*}\right)\right] \gtrless 0 . \qquad (26)$$

The term $1/\delta$ is the marginal valuation (in terms of future goods) of additional international borrowing while $(1/\delta^*)(1 - 1/\eta^*)$ is the marginal social cost of such borrowing. The optimum tax on internatioal borrowing would equate the two.[8] Hence domestic welfare improves or deteriorates with a switch in government financing from domestic to foreign sources as the tax equivalent of capital controls is above or below the optimum level.

The implications of the switch in government financing for domestic macroeconomic aggregates can be derived by using (25) and (26) along with (1), (2), and the domestic consumption demand and labor supply functions. Without formally deriving these results, note that this sort of policy may lead to the

negative comovement in macroeconomic aggregates that Morgenstern (1959) documented for the interwar years. As an example, suppose that the tax equivalent of domestic capital controls is above the optimum level so that the financing change improves domestic welfare. In this case both substitution and wealth effects work to expand domestic consumption and investment while output and employment contract. These movements are all in the opposite direction from those of their foreign counterparts and would be reflected in negative international comovements in real interest rates and macroeconomic aggregates.[9] Yet another insight this example highlights is the possibility that in an open economy with capital controls deficit financing, of the international variety, may be contractionary in the sense of reducing output and employment. These results run counter to those usually attributed to deficit financing in closed economies where output and employment are demand determined and government bonds are viewed as net wealth.

B. Domestically Financed Changes in Government Purchases

Both temporary and permanent shifts in government purchases that are domestically financed can be examined using the model. However, in the benchmark case discussed in Section II.B, permanent changes in government purchases were shown not to be transmitted internationally. Since capital controls seem unlikely to enhance prospects for international transmission, the focus here, and in the following sections, is on temporary changes in government purchases.

It is immediately apparent that capital controls prevent the international transmission of domestically (tax or debt) financed temporary changes

in government purchases. This occurs because the foreign country's only link with the domestic economy is through its current account balance [c.f. equations (18) and (19)] which is constrained to remain fixed at $b^* = -\tilde{b}$. From (20) and (21) it follows that

$$\frac{du}{dG^1} = \frac{-(1 - \alpha^1 - h_G^1)}{E_u} < 0 , \tag{27}$$

$$\frac{d\delta}{dG^1} = \frac{-(1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)}{A} < 0 . \tag{28}$$

Domestic welfare deteriorates due to the negative wealth effects associated with government purchases while the real interest rate rises to clear the domestic market. In light of these changes domestic consumption and investment decline while output and employment expand. In fact, it is easy to demonstrate that the resulting changes are identical to those that would occur in a closed economy. Not surprisingly, this is a consequence of the fact that capital controls eliminate all international transmission of domestically financed shifts in government purchases. However, whether macroeconomic aggregates respond more or less (in absolute terms) than with fully integrated capital markets is unclear. Since capital controls prevent incipient excess demands for or supplies of goods from being transmitted to world markets, the domestic real interest rate responds more strongly to temporary changes in government purchases than it would in a fully integrated world economy. This tends to magnify the impact of temporary changes in government purchases by strengthening substitution effects under capital controls. Running counter to this is the fact that capital controls eliminate the intertemporal terms of trade effects associated with government purchases in a fully integrated world economy. Hence wealth effects are dampened by capital controls.

C. Internationally Financed Changes in Government Purchases

Suppose that instead of financing a temporary increase in government purchases domestically the home country were to tap the world capital market ($d\tilde{b} = dG^1$). In this case (22) and (23) indicate that due to the method of financing there will be international transmission. In fact, the effects on the foreign country will be identical to those given by equations (24a) - (24f). This emphasizes an important difference in the international transmission process created by capital controls: With fully integrated capital markets financing decisions are (to a first-order approximation) irrelevant for the international transmission of fiscal policy. The crucial element is the type and magnitude of shifts in government purchases. However, capital controls turn things upside down. The crucial element for international transmission under capital controls is the method of financing; the type and magnitude of government purchases is largely irrelevant.

Comparing international transmission in this case to that in a fully integrated world economy, note that the qualitative response of foreign variables to temporary changes in domestic government purchases is the same in the two cases. This suggests that, to some extent, when international transmission occurs it is inconsequential from the foreign perspective whether or not the home country has capital controls. The key difference arises because only certain types of domestic government purchase shocks, those financed by floating public debt on the world market, are transmitted to the rest of the world. However, further investigation reveals that under capital controls foreign real interest rates are more sensitive to temporary changes in government purchases that are internationally transmitted,[10] and hence foreign macroeconomic aggregates will experience larger fiscal induced fluctuations when domestic policies are transmitted abroad. Overall then, home country

fiscal induced fluctuations in the foreign economy may be magnified or mitigated when capital controls are enacted by the home country. The larger the share of domestic government purchases that (at the margin) is financed internationally, the more likely it is that the presence of capital controls will produce larger fluctuations in foreign macroeconomic aggregates in response to domestic government purchase shifts.[11]

In assessing the domestic impact of temporary increases in government purchases financed by international sales of public debt, it is useful to realize that such a policy is equivalent to a domestically financed increase in government purchases plus a switch from domestic to international financing. Therefore, domestic behavior can be found by simply adding the results uncovered in Sections IV.A and IV.B. From (27) and (28) it is apparent that domestic welfare may rise or fall, although the former is a possibility only if the tax equivalent of capital controls is above the optimum level. It can also be shown that domestic real interest rates fall. In light of the rise in foreign real interest rates, internationally financed shifts in domestic government purchases under capital controls can be seen to be characterized be negatively correlated real interest rate movements.

To see that the domestic real interest rate does indeed fall, combine (25) and (28) to obtain

$$\frac{d\delta}{dG^1}\Big|_{d\tilde{b}=dG^1} = \frac{-(1-\alpha^1-h_G^1)(1-c_W^1-y_W^1)}{A} + \frac{[\,1-(c_W^1+y_W^1)(1-\frac{\delta}{\delta^*})\,]}{A}$$

$$- \frac{c_W^1+y_W^1}{A}\,\frac{d\tilde{b}}{(\delta^*)^2}\,\frac{d\delta^*}{dG^1}\Big|_{d\tilde{b}=dG^1}$$

$$= \frac{(\alpha^1+h_G^1)(1-c_W^1-y_W^1)+\frac{\delta}{\delta^*}(c_W^1+y_W^1)}{A} - \frac{c_W^1+y_W^1}{A}\,\frac{d\delta^*}{(\delta^*)^2}\,\frac{d\delta^*}{dG^1}\Big|_{d\tilde{b}=dG^1} > 0\,. \tag{29}$$

There are three forces at work here. First, the temporary increase in government purchases works to raise the domestic real interest rate by $-(1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)/A$ as it would in a closed economy. Second, the effective easing of capital controls due to the international financing of government purchases works to reduce the domestic real interest rate. Third, the rise in the foreign real interest rate is negatively transmitted to the home country. Note that the algebra indicates that the implicit easing of capital controls dominates the tendency for increased government purchases to raise the real interest rate. That is, international transmission aside, the domestic real interest rate tends to fall. The intuition underlying this result is readily apparent. Focusing on the second line of (29), the term δ/δ^* is the discounted value of the future debt repayment obligations the economy incurs on (each unit of) its extra foreign borrowing. Smoothing behavior by the private sector implies that a portion of these obligations, $c_W^1 + y_W^1$, will be financed by reducing current consumption and increasing current output (i.e., reducing current leisure). The term $\alpha^1 + h_G^1$ represents the temporary increase in income due to the public services provided by the additional government purchases. In order to smooth their consumption and leisure profiles, the private sector saves $1 - c_W^1 - y_W^1$ of this. On both counts then there is an excess supply of goods which must be eliminated by a fall in the domestic real interest rate. [In going from the first to the second line of (29) $1 - c_W^1 - y_W^1$ terms cancel. This is because, after adjusting for wealth effects, the additional resources made available by the increased foreign borrowing just match the extra resources demanded due to the additional government purchases.]

Finally, as a general matter it is unclear whether internationally financed temporary increases in government will have (in absolute value terms) a

stronger impact on domestic macroeconomic aggregates under capital controls than under fully integrated capital markets. The details of the argument follow directly from splicing together the discussions of Sections IV.A and IV.B. In conjunciton with the results outlined in Section IV.B, it is therefore unclear what effect imposing capital controls will have on the overall fluctuations in the domestic economy emanating from shifts in domestic fiscal policy. Notice that if intertemporal substitution effects are strong enough, however, it is again possible to observe negative rather than positive fiscal induced comovements in macroeconomic aggregates.

V. Capital Controls and Foreign Fiscal Policy

So far the focus has been on the international transmission of fiscal policies from a country with capital controls to the rest of the world. It is also of interest to know how fiscal policies enacted by the rest of the world are transmitted to a country with capital controls. A glance at (11) indicates that with fully integrated capital markets a temporary increase in foreign government purchases raises the world real interest rate. Home welfare therefore falls, and it follows immediately that since substitution and wealth effects work in the same direction domestic output and employment expand while consumption and investment contract. Foreign welfare may move in either direction but as long as substitution effects dominate wealth effects, in the sense that $c^{*1}_{\delta} + w^{*2}c^{*1}_{\delta w} - (b^1/\delta)c^{*1}_{W} > 0$ and $\ell^{*1}_{\delta} + w^{*2}\ell^{*1}_{\delta w} - (b^1/\delta)(\ell^{*1}_{u}/E_u) < 0$, foreign macroeconomic aggregates will be positively correlated with their domestic counterparts. These results serve as a backdrop for the comparisons that follow.

Under capital controls it is straightforward to show that

$$\frac{d\delta^*}{dG^{*1}} = \frac{-(1 - \alpha^{*1} - h_G^{*1})(1 - c_W^{*1} - y_W^{*1})}{A^*} < 0 ,$$

$$\frac{du^*}{dG^{*1}} = \frac{-(1 - \alpha^{*1} - h_G^{*1})}{E_u^*} - \frac{\tilde{b}}{E_u^* \delta^*} \frac{d\delta^*}{dG^{*1}} \gtrless 0 ,$$

$$\frac{dc^{*1}}{dG^{*1}} = \left[c_\delta^{*1} + w^{*2} c_{\delta w}^{*1} - (\tilde{b}/\delta^*) c_W^{*1} \right] \frac{d\delta^*}{dG^{*1}} - c_W^{*1}(1 - \alpha^{*1} - h_G^{*1}) - \alpha^{*1} < 0 ,$$

$$\frac{d\ell^{*1}}{dG^{*1}} = \left[\ell_\delta^{*1} + w^{*2} \ell_{\delta w}^{*1} - (\tilde{b}/\delta^*)(\ell_u^{*1}/E_u^*) \right] \frac{d\delta^*}{dG^{*1}} - (\ell_u^{*1}/E_u^*)(1 - \alpha^{*1} - h_G^{*1}) > 0 ,$$

$$\frac{dy^{*1}}{dG^{*1}} = w^{*1} \frac{d\ell^{*1}}{dG^{*1}} + h_G^{*1} > 0 ,$$

$$\frac{dI^{*1}}{dG^{*1}} = I_\delta^* \frac{d\delta^*}{dG^{*1}} < 0 .$$

These results are qualitatively the same as in the absence of capital controls. However, with the aid of (11) it can be seen that a temporary increase in foreign government purchases raises real interest rates more under capital controls because none of the excess demand for goods can be transmitted to the home country[12]. Using this it can be shown that under capital controls foreign macroeconomic aggregates will undergo wider swings in response to foreign fiscal shocks than with fully integrated capital markets. Combining this with the earlier discussion of the international transmission of domestic fiscal policy, it follows that the imposition of capital controls by the home country may result in more pronounced overall fiscal induced fluctuations in foreign macroeconomic aggregates. This possibility reflects the fact that the imposition of capital controls severely curtails trading opportunities -- there is thus a tendency for disturbances to have more pronounced effects under capital controls because there is less spillover to world markets.

Turning to the domestic economy, it can be seen from (20) and (21) that the domestic real interest rate falls and home welfare deteriorates:

$$\frac{d\delta}{dG^{*1}} = \frac{-(c_W^1 + y_W^1)}{A} \frac{\delta\tilde{b}}{(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} > 0 , \tag{30}$$

$$\frac{du}{dG^{*1}} = \frac{\delta\tilde{b}}{E_u(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} < 0 . \tag{31}$$

Again real interest rate movements are negatively correlated under capital controls.

Substitution and wealth effects run counter to one another, so without restricting preferences the qualitative nature of domestic consumption, employment, and output movements cannot be pinned down. However, if preferences are time separable,[13] an assumption which is adopted at the outset in most intertemporal models [see, for example, Frenkel and Razin (1984a,b) and Greenwood and Kimbrough (1984)], it can be shown that (the results for c^1 are worked out in detail in the appendix)

$$\frac{dc^1}{dG^{*1}} = \frac{\delta\tilde{b}c_W^1 I_\delta}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} < 0 ,$$

$$\frac{d\ell^1}{dG^{*1}} = \frac{\delta\tilde{b}(\ell_u^1/E_u)I_\delta}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} > 0 ,$$

$$\frac{dy^1}{dG^{*1}} = \frac{-\delta\tilde{b}y_W^1 I_\delta}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} > 0 ,$$

$$\frac{dI^1}{dG^{*1}} = I_\delta \frac{d\delta}{dG^{*1}} > 0 .$$

Domestic consumption, employment, and output thus respond similarly to foreign fiscal policy under capital controls as they do in a fully integrated world

economy. Note that under capital controls positive international comovements in output, employment, and consumption (but not investment) continue to characterize foreign fiscal shocks. This implies that macroeconomic aggregates are more likely to exhibit negative correlation in response to fiscal shifts emanating from countries levying capital controls than in response to fiscal shifts originating in countries allowing free capital movements.

Comparing the magnitude of these domestic responses to their counterparts in a fully integrated world economy, notice that substitution and wealth effects work in the same direction in the absence of capital controls but work against one another in their presence. Note also that wealth effects are similar under both regimes, and that the assumption of time separable preferences essentially guarantees that wealth effects dominate under capital controls. The upshot of all this is that the impact of foreign fiscal shocks on domestic output, employment, and consumption tends to be muted by capital controls. The insulation from foreign shocks afforded by capital controls is, of course, one reason why they are so prevalent.[14]

VI. Conclusion

A number of propositions concerning the international transmission process and the implications of capital controls for the international transmission of fiscal policy have now been discussed. Some of the most important results that have been derived include the following:

1. In the absence of capital controls intertemporal substitution effects tend to generate positive international comovements in macroeconomic aggregates such as output, employment, consumption, and investment, while wealth effects

associated with intertemporal terms of trade changes create a tendency for negative comovements. If these wealth effects are not large (in a sense defined precisely in the main text), fluctuations in macroeconomic aggregates will be positively correlated across countries when capital markets are fully integrated. However, because they result in negatively correlated real interest rate movements, the imposition of capital controls leads substitution effects to work toward creating negative comovements in macroeconomic aggregates.

2. In the presence of capital controls, macroeconomic aggregates are more likely to exhibit negative cross-country correlation in response to fiscal shocks generated by countries imposing capital controls than in response to fiscal shocks occurring in countries allowing free capital movements.

3. In countries with capital controls Ricardian equivalence holds between taxes and domestically issued public debt but not between taxes and internationally issued public debt. This reflects the fact that sales of public debt on the world market represent an effective loosening of capital controls.

4. Financing decisions are largely irrelevant for the international transmission process when capital markets are fully integrated, but are the crucial element when considering the international transmission of fiscal policies undertaken by countries with capital controls.

5. Overall, fiscal induced fluctuations in macroeconomic aggregates may become more pronounced in countries allowing free capital flows when their trading partners impose capital controls.

6. Instituting a system of capital controls helps to insulate a country from fiscal induced fluctuations originating abroad but has ambiguous implications for the size of fiscal induced fluctuations of domestic origin.

It should be borne in mind that these results apply not only to countries operating a formal system of capital controls but to others interferring with capital flows as well. For instance, the results also apply to countries that tax international capital flows in order to attain a target capital account. However, unless tax rates are actively managed to attain quantitative targets, taxing capital flows will have more in common with a system of integrated capital markets than with a system of capital controls. This is because taxes on capital flows while driving a wedge between domestic and world real interest rates leave the link between them intact. Capital controls, on the other hand, sever this link so that capital markets take on the characteristics of markets for nontraded goods. Therefore, real interest rate movements remain positively correlated when capital flows are taxed but become negatively correlated when capital controls are put in place. In addition to systems of taxes on capital flows aimed at a target capital account, dual exchange rate systems also have the same implications for the international transmission process as capital controls. This follows from the fact that dual exchange rates can be demonstrated to be equivalent to capital controls [see Adams and Greenwood (1983)]. In light of the fact that roughly three quarters of the world's countries have capital controls, and many more tax capital flows or operate dual exchange rate systems, the results outlined in this paper should have widespread applicability in interpreting international comovements in real interest rates, output, employment, consumption, and investment.

One possibly troubling implication of the results presented here is that in the absence of capital controls there should apparently be no international concern about the methods a country uses to finance its government purchases: the only concern should be with the overall level and timing of these purchases. At the root of this result is the fact that with free capital flows Ricardian equivalence holds. When Ricardian equivalence is broken the international transmission of budget deficits becomes an important issue as is highlighted by Frenkel and Razin (1984b). In their work an overlapping generations model where agents without a bequest motive die stochastically is employed. The fact that individuals' lifetimes are uncertain results in private borrowing and lending activity being undertaken at effective interest rates which reflect the probability of dying. The government, being immortal, borrows and lends at risk-free interest rates. The divergence between private and public interest rates violates the assumptions necessary to ensure the Ricardian equivalence theorem holds. An alternative departure from the Ricardian framework would be to assume that revenues must be raised by distortionary income taxes. Here the government's financing decisions matter since the timing of taxes has important real effects.[15] If the government raises its revenues in a manner that maximizes societal welfare, the time profile of income taxes will be dictated by a Ramsey tax rule. The general outcome is that taxes should be smoothed over time so as to minimize the deadweight burden of taxation, a point Barro (1979, 1984) has emphasized. This would yield an optimal profile for the public debt and a richer analysis of the international transmission of fiscal policy. Countries might have special concerns about increased budget deficits in the nations they trade with in as much as they may be associated with unusually large levels of government purchases (perhaps because a scaling down of future government

activity is expected). This is one possible area for future research on the international transmission of fiscal policy.

Appendix

From the domestic consumption function it follows immediately that

$$\frac{dc^1}{dG^{*1}} = (c^1_\delta + w^2 c^1_{\delta w}) \frac{d\delta}{dG^{*1}} + c^1_u \frac{du}{dG^{*1}} .$$

After substituting (30) and (31) into this expression it can be seen that

$$\frac{dc^1}{dG^{*1}} = - \left[(c^1_\delta + w^2 c^1_{\delta w})(c^1_W + y^1_W) - c^1_W A \right] \frac{\delta \tilde{b}}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} .$$

Since $A = c^1_\delta + w^2 c^1_{\delta w} + I_\delta - w^1(\ell^1_\delta + w^2 \ell^1_{\delta w})$ this reduces to

$$\frac{dc^1}{dG^{*1}} = - \left\{ y^1_W (c^1_\delta + w^2 c^1_{\delta w}) - c^1_W \left[I_\delta - w^1(\ell^1_\delta + w^2 \ell^1_{\delta w}) \right] \right\} \frac{\delta \tilde{b}}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} .$$

However, when preferences are time separable, $- c^1_\delta / w^1 \ell^1_\delta = c^1_W / y^1_W = - c^1_{\delta w} / w^1 \ell^1_{\delta w}$ as shown by Barro and King (1982). Therefore, $y^1_W (c^1_\delta + w^2 c^1_{\delta w}) + c^1_W w^1 (\ell^1_\delta + w^2 \ell^1_{\delta w}) = 0$ and the preceding expression reduces to

$$\frac{dc^1}{dG^{*1}} = \frac{\delta \tilde{b} c^1_W I_\delta}{A(\delta^*)^2} \frac{d\delta^*}{dG^{*1}} < 0$$

as was to be shown.

Footnotes

[1]Two points should be noted regarding this assumption. First, it characterizes other open economy studies of fiscal policy, such as Greenwood (1983) and Frenkel and Razin (1984a), which abstract from the consumption and production services provided by government purchases in order to focus solely on the tax liabilities they carry with them. Second, empirical evidence presented by Ahmed (1983) is consistent with this assumption. Examining data for the period 1908-1980, he found that α^t and h_G^t were around 0.40 and 0.36.

[2]This definition differs from that of Barro (1981). He defined temporary changes in government purchases in such a way that they have no wealth effects. In the present context the analogy would be to define as temporary those shifts in government purchases that have no impact on home agents' utility. The difficulty one encounters here is that in an open economy changes in the real interest rate alter utility as discussed in relation to (10). This problem does not arise in a closed economy since real interest rate changes have no aggregate wealth effects.

[3]Wealth effects are irrelevant for investment behavior because of the assumption that the marginal product of capital is independent of employment.

[4]See Frenkel and Razin (1984a) for a discussion of the role played by movements in the atemporal terms of trade.

[5]Even when $d\delta/dG = 0$ there would be some international transmission if the model were disaggregated enough to allow for atemporal relative price movements. However, these types of influences should primarily alter the inter-

sectoral allocation of resources. They should only be of second-order importance for movements in economy-wide aggregates.

[6]This notion underlies results in Obstfeld's (1984) example of a devaluation having real effects under dual exchange rates.

[7]The numerator of this term can be written as $1 - (c_W^1 + y_W^1)(1 - \frac{\delta}{\delta^*})$ $= 1 - (c_W^1 + y_W^1)(\frac{r - r^*}{1 + r})$ where $(\frac{r - r^*}{1 + r})$ is the wealth increase associated with relaxing capital controls. Easing capital controls by a unit increases the supply of current goods available domestically by the additional unit than can be borrowed internationally, and increases spending on current goods by $c_W^1 + y_W^1$ times the increase in wealth. $1 - (c_W^1 + y_W^1)(\frac{r - r^*}{1 + r})$ is thus the excess supply of goods at the initial real interest rate that results from loosening capital controls.

[8]With the optimum tax in place the term in brackets in (26) is zero which implies $\delta^*/\delta = 1 - 1/\eta^*$. With the tax set at τ, $\delta = 1/(1 + \tau)(1 + r^*)$ $= \delta^*/(1 + \tau)$. Therefore, $\delta^*/\delta = 1 + \tau$ and the optimum tax is $\tau = -1/\eta^* > 0$. This is just the standard optimum tariff type formula. With capital controls in place the elasticity of the foreign offer curve, η^*, is given by $\eta^* = -(\delta^*/\tilde{b})A^*$. Now, from equations (18), (19), and the definition of A^* it is easy to deduce that both δ^* and A^* are functions of $\tilde{b}$ and the exogenous levels of domestic government purchases, G^{*1} and G^{*2}. Similarly, from (16) and (17) it can be seen that δ is a function of $\tilde{b}$ and the exogenous levels of domestic government purchases, G^1 and G^2. Consequently, it follows that by manipulating the target level for the capital account, $\tilde{b}$, the government can effectively set $\delta^*/\delta = 1 - 1/\eta^*$ as required

by the optimum tariff rule.

[9]Of course, these results could also hold if the tax equivalent of capital controls was below but sufficiently close to the optimum level so that substitution effects dominate wealth effects.

[10]To see this recall that without capital controls $d\delta^*/dG^1 = -(1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1)/\Delta$ while with capital controls $d\delta^*/dG^1 = -1/A^*$. The statement made in the text follows from the facts that $(1 - \alpha^1 - h_G^1)(1 - c_W^1 - y_W^1) < 1$ and $\Delta > A^*$ (so long as b^1 is not significantly larger than $\tilde{b}$).

[11]This holds constant the magnitude of domestic government purchase shifts across regimes. If, as is often the case, capital controls are adopted to combat large current account deficits created by heightened fiscal activity, the tendency for capital controls to be destabilizing from the foreign perspective will be even more pronounced.

[12]The formal argument is essentially the same as in footnote 10.

[13]Although this assumption simplifies the formal results discussed in Section IV it does not eliminate any of the ambiguities detailed in Parts A and C. In particular, it is not inconsistent with the possibility of negative comovements in macroeconmic aggregates that was discussed there.

[14]This motive is present even for small, developing countries for which optimum tariff type arguments cannot provide a welfare based rationale for

capital controls. Although optimum tariff arguments do not apply to these countries, the myriad of capital controls and exchange restrictions these countries have enacted seem likely, when taken as a group, to exert a strong influence on world real interest rates and the international transmission process along the lines outlined here.

[15]Recent discussions along these lines in an open economy context include Razin and Svensson (1983) and Kimbrough (1984).

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