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CREDIT RATIONING IN AN OPEN ECONOMY*

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This paper claims that credit markets' imperfections matter significantly to open economies, and can alter basic macroeconomic results. This is demonstrated in the paper by use of an open economy model with individual credit rationing, due to asymmetric information and moral hazard. The paper concentrates on the effect of fiscal policy and shows that when credit is rationed, the standard result does not hold and a fiscal expansion may create a surplus instead of a deficit in the current account. Furthermore, the paper shows that whether credit is rationed or not depends on the tax burden.

1. INTRODUCTION

One of the basic assumptions of standard macroeconomic analysis of open economies is that credit markets are perfectly competitive, in addition to the assumption of capital mobility.[2] This paper claims that if the assumption is removed and credit market imperfections are introduced, the macroeconomic analysis of the open economy changes significantly. Furthermore, the paper shows that such credit market imperfections can contribute to the explanation of empirical phenomena, which appear to be inconsistent with standard open economy theory.

In order to demonstrate this claim the paper presents a dynamic general equilibrium model of an open economy, in which information on individual investment in human capital is asymmetric. In the tradition of Jaffee and Russel (1976) and Stiglitz and Weiss (1981, 1987), we show that as a result of this asymmetric information, credit may be endogenously rationed in some situations, as a precautionary measure against the possibility of moral hazard. We then examine within this model, how the open economy is affected by fiscal policy. More specifically we examine the well-known Mundell–Fleming result, that under capital mobility a fiscal expansion worsens the balance of payments and creates a current account deficit on impact.[3] The analysis of our asymmetric information model shows that in situations where credit is not rationed, the Mundell-Fleming result does indeed hold, but if credit rationing prevails this result no longer holds. We

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[2] Notice that these are two independent assumptions. Capital mobility means that home and foreign capital markets are integrated, as there are no formal barriers to trade in assets, but these markets can be perfect or imperfect, as shown in this paper.

[3] See Fleming (1962) and Mundell (1963). For later proofs of this result in optimizing models, see Blanchard (1983), Persson (1985), Sachs (1982) and Zeira (1991).

show that under credit rationing a fiscal expansion may crowd out domestic demand so much, that the current account may even improve.

The reversal of the Mundell–Fleming result under credit rationing is therefore an example of how credit rationing can drastically alter major macroeconomic results in the open economy, and there are other examples as well.[4] But showing that fiscal expansions may create a current account surplus if credit is rationed is important not only theoretically, but empirically as well. It has long been observed that the Mundell–Fleming result does not hold in many countries. In a recent article Borensztein (1989) reports on a simple test of correlations between fiscal policies and current accounts in 30 countries, where the results "show an almost even split between countries which show a positive association between fiscal deficits and current account deficit and countries which show a negative association," (Borensztein 1989, p. 54).

There have been some attempts to find a theoretical explanation to these observations, which are clearly inconsistent with standard open economy theory. Penati (1987) and Borensztein (1989) show that under some specifications of utility or cost functions the Mundell–Fleming result can be reversed. But such an explanation is problematic, as we observe different correlations between budget and current account deficits even in countries which have very similar technologies and tastes, such as Sweden and Norway, or the U.S. and the U.K., or Denmark and The Netherlands.[5]

This paper suggests an alternative way to account for the stylized facts described above. As already mentioned, we show that the correlation between the current account and fiscal policy depends on whether credit is rationed or not. Furthermore, it is also shown in the paper that credit rationing itself depends on fiscal policy, namely on the tax burden. Thus, according to our theory countries with the same tastes and technology may differ with regard to their reaction to changes in fiscal policy, simply because they have different tax burdens.

The paper is organized as follows. Section 2 presents the model and Section 3 describes lending and borrowing and introduces the incentive compatibility constraint. Section 4 describes equilibrium borrowing with or without credit rationing. Section 5 examines the effect of a fiscal expansion when credit is not rationed and shows that the Mundell–Fleming result holds, while Section 6 shows that this result does not hold under credit rationing. In Section 7 we show that whether credit is rationed or not depends on the tax burden in the economy. Section 8 discusses the results and their generality, while Section 9 summarizes the paper.

[4] Another result is that under credit rationing, a rise in the propensity to save may lead the economy to a greater foreign debt, contrary to conventional result. See Zeira (1988).

[5] Another attempt to explain the empirical failure of the Mundell–Fleming result was made by Sachs and Wyplosz (1984), who suggested that if home and foreign assets are imperfect substitutes, the crowding out effect may be high enough to reverse the Mundell–Fleming result. See also Dornbusch (1986). But Zeira (1991) shows that this hypothesis does not hold in an optimizing model, even if risk and imperfect capital mobility are assumed.

2. THE MODEL

Consider a small economy in a world with only one tradable physical good, which is produced by labor only. There is full capital mobility, namely the economy has free access to international capital markets, where the riskless rate of interest is r^* and is assumed to be fixed over time.

The economy consists of overlapping generations, where each individual lives three periods of time, going from young to grown-up and then to old. We assume that there is no population growth and in each generation there is a continuum of size one of individuals. Each person in this economy works in second period of life only, but can invest in human capital when young, in order to increase the probability of success when grown up. Thus, an individual who invests I in human capital when young, can become successful and produce W_s units of the good, or not succeed and produce only W_n units, where $W_n < W_s$.[6] Success or failure are unknown in advance and are independent events among individuals. The probability of success is p, $0 < p < 1$, which is the same for all individuals who invest in human capital. Thus a proportion of p of those who invest is successful. An individual who does not invest in human capital when young, produces W_n only. Thus investment in human capital can be viewed as raising the probability of success from 0 to p. It is further assumed that investment in human capital is profitable on average.

$$pW_s - pW_n > I(1 + r^*). \tag{1}$$

The utility of each young individual is described by

$$U = u(c_1) + \beta u(c_2) + \beta^2 u(c_3), \tag{2}$$

where c_i is consumption in the ith period of life, $\beta > 0$ is a subjective rate of time preference and u is an increasing concave temporal utility function which is continuously differentiable. It is assumed that u does not satisfy the Inada condition and $u'(0)$ is finite.[7] Without loss of generality we can therefore assume that: $u(0) = 0$. Utility of grown-ups and old is defined to be consistent with (2). Individuals maximize their expected lifetime utility in each period of life.

There is a government in the economy and fiscal policy in period t is characterized by public consumption G_t, taxes on labor income T_t and public debt D_t. These variables must satisfy the following budget constraint,

$$D_t = G_t + D_{t-1}(1 + r^*) - T_t. \tag{3}$$

Regularly the government follows a fixed fiscal policy which keeps the budget balanced: $D_t = D$, $T_t = T$ and $G_t = G = T - r^* \cdot D$.

As for markets in this economy we assume that they are competitive and expectations are rational. Default is allowed, but in such a case lenders get hold of

[6] The assumption that investment in human capital is indivisible is only a simplifying assumption and none of the results depends on it. This is shown in Zeira (1988), where a continuous function of investment in human capital is used.

[7] This assumption too is not critical for the results of the paper. It can be replaced by the assumption that the legal system enables a minimum income, even when an individual defaults.

all disposable income of the defaulting borrower. Thus disposable income serves as a collateral. We further assume that there are financial intermediaries in the credit market, and due to perfect competition and free entry they operate on zero profits.

Finally we add asymmetric information to the model, as we assume that each young individual is the only one who knows whether she invests in human capital or not. An individual can purchase goods in first period of life and use them either for consumption or for investment in human capital, and their use is known to this individual only and to no one else. Others can only observe the amount produced by the individual when grown up.

3. LENDING AND BORROWING

It is clear that in this model the lenders are grown-ups, saving for old age, while the young are borrowing, to finance both consumption and investment in human capital.

Let us describe lenders first. A grown-up individual, who is left with an amount Y_t after paying taxes and paying back debt, or collateral in case of default, faces the following optimization problem,

$$\max_{0 \leq L_t \leq Y_t} \{u(Y_t - L_t) + \beta[L_t(1 + r^*)]\}, \tag{4}$$

where L_t is the amount of lending.

The first order condition for this maximization problem is

$$u'(Y_t - L_t) = \beta(1 + r^*)u'[L_t(1 + r^*)], \tag{5}$$

but since u is not satisfying the Inada condition, the FOC does not always hold and a corner solution may occur, where $c_2 = 0$ or $c_3 = 0$.[8] But whether an interior or a corner solution, we can always define the functions v and L,

$$v(Y) = \max_{0 \leq L \leq Y} \{u(Y - L) + \beta u[L(1 + r^*)]\}, \tag{6}$$

and

$$L(Y) = \arg\max_{0 \leq L \leq Y} \{u(Y - L) + \beta u[L(1 + r^*)]\}, \tag{7}$$

and show that

a. v and L are continuous, and v is continuously differentiable,
b. v is an increasing and concave function,
c. L is nondecreasing with a slope smaller or equal to one,
d. $L(0) = 0$ and $v(0) = 0$.

Hence, an individual who happens to be grown-up in period t, lends an amount $L_t = L(Y_t)$, where Y_t is the amount left after taxes, debt and collateral are paid.

We now turn to describe borrowing by the young, which involves risk and a

[8] Notice that (4) has a corner solution in the neighborhood of $Y_t = 0$ whenever $\beta(1 + r^*) \neq 1$.

possibility of default. Consider a young individual who borrows an amount B_t in period t. It is clear that the borderline between default and no default is at $\bar{B}_t$, where

$$\bar{B}_t = \frac{W_n - T_{t+1}}{1 + r^*}. \tag{8}$$

As long as $B_t \leq \bar{B}_t$ there is no default risk and the individual can borrow up to this amount at the riskless rate of interest r^*. If B_t is greater than $\bar{B}_t$, there is default either if the individual has invested in human capital and failed or if the individual has not invested in human capital at all.

It is clear that if lenders believe that borrowers do not invest in human capital, they do not lend them more than $\bar{B}_t$, since otherwise their return will be less than r^* with probability one. If lenders believe that borrowers do invest in human capital, they can lend them more than $\bar{B}_t$, but at a higher interest rate. This is possible since individual default risk can be averaged, as there is a continuum of individuals and as success and failure are independent among individuals. The borrowing interest rate r_t for borrowing an amount B_t is therefore determined by

$$B_t(1 + r^*) = pB_t(1 + r_t) + (1 - p)(W_n - T_{t+1}), \tag{9}$$

which is a zero profit condition for financial intermediation. In order to find out when do lenders believe that borrowers indeed invest in human capital, let us introduce the incentive compatibility constraint.

Let $U_i^t(B_t)$ be expected lifetime utility of an individual, who invests in human capital in period t and borrows an amount B_t. Let $U_{ni}^t(B_t)$ be lifetime utility of an individual born in t, who borrows B_t and does not invest in human capital. The individual can borrow an amount B_t greater than $\bar{B}_t$, only if lenders believe she prefers to invest in human capital, namely, as long as

$$U_i^t(B_t) \geq U_{ni}^t(B_t). \tag{10}$$

This is the incentive compatibility constraint.[9] This constraint is necessary for lenders due to the asymmetric information in this model. Lenders do not know whether an individual invests in human capital or not, and they cannot verify it ex post, if the individual earns only W_n. Thus they are not willing to lend more than $\bar{B}_t$, unless (10) is satisfied. In the next section we show that credit can be rationed, if the incentive compatibility constraint is binding.

4. EQUILIBRIUM

In order to continue our analysis of individual choice, we have to examine more closely the functions U_i and U_{ni}. Expected lifetime utility of an individual who invests in human capital is

$$\begin{aligned} U_i^t(B_t) = u(B_t - I) &+ \beta p v[W_s - T_{t+1} - B_t(1 + r^*)] \\ &+ \beta(1 - p)v[W_n - T_{t+1} - B_t(1 + r^*)], \end{aligned} \tag{11}$$

[9] Notice that we assume in (10) that when utility is the same, individuals prefer to invest in human capital.

if $B_t \leq \bar{B}_t$ and there is no default risk. If $B_t > \bar{B}_t$,

$$U_i^t(B_t) = u(B_t - I) + \beta p v\{[\bar{W} - T_{t+1} - B_t(1 + r^*)]p^{-1}\}, \tag{12}$$

where $\bar{W}$ is average productivity of investors in human capital,

$$\bar{W} = pW_s + (1 - p)W_n. \tag{13}$$

The lifetime utility of an individual who does not invest in human capital is

$$U_{ni}^t(B_t) = u(B_t) + \beta v[W_n - T_{t+1} - B_t(1 + r^*)], \tag{14}$$

if $B_t \leq \bar{B}_t$, and

$$U_{ni}^t(B_t) = u(B_t), \tag{15}$$

when $B_t > \bar{B}_t$ and the individual defaults with probability one. Notice that both U_i^t and U_{ni}^t are continuous functions, but their derivatives are discontinuous at $\bar{B}_t$, where the right-hand derivative is greater than the left-hand derivative, for both functions.

Figure 1 presents two examples of the curves U_i^t and U_{ni}^t. There are two hidden assumptions behind Figure 1. The first is that U_i^t is increasing for $I \leq B_t \leq \bar{B}_t$, and hence an individual who invests in human capital would prefer to borrow more than $\bar{B}_t$ and enter the range of default risk. The second is that below $\bar{B}_t$ individuals prefer to invest in human capital,

$$U_i^t(\bar{B}_t) > U_{ni}^t(B_t), \quad \text{for all} \quad B_t \leq \bar{B}_t. \tag{16}$$

Notice that (16) does not necessarily follow from the assumption that investment in human capital is profitable on average, as described in equation (1), since it is also risky.[10]

It can be shown that if W_s is sufficiently large, p sufficiently high, and if the subjective rate of time preference β is not excessively high, then these two conditions hold for all feasible levels of taxes.[11] If β is too high individuals prefer not to borrow much for present consumption and there's no default risk. If income in case of success W_s and the probability of success p are not high enough, individuals may prefer not to invest in human capital, since it is a risky investment. Clearly both these cases are not very interesting if we wish to investigate credit constraints. We therefore assume, in addition to the basic assumptions of the model, that W_s and p are relatively high and β not too high, which is very plausible. Hence, individuals prefer to invest in human capital and to borrow more than $\bar{B}_t$, and are therefore in the domain of default risk.

[10] This risk cannot be insured due to the moral hazard problem that arises when information is asymmetric.

[11] At $\bar{B}_t$ we have: $U_i^{t\prime}(\bar{B}_t) > u'[W_n/(1 + r^*) - I] - \beta p(1 + r^*)v'(W_s - W_n) - \beta(1 - p)(1 + r^*)v'(0)$, for all taxes. This is nonnegative if β is not too high and W_s and p are sufficiently high. Hence U_i^t is increasing in $[I, \bar{B}_t]$. By applying equations (12) and (14) we can show that $U_i^t(\bar{B}_t) > U_{ni}^t(B_t)$, if W_s and p are sufficiently high.

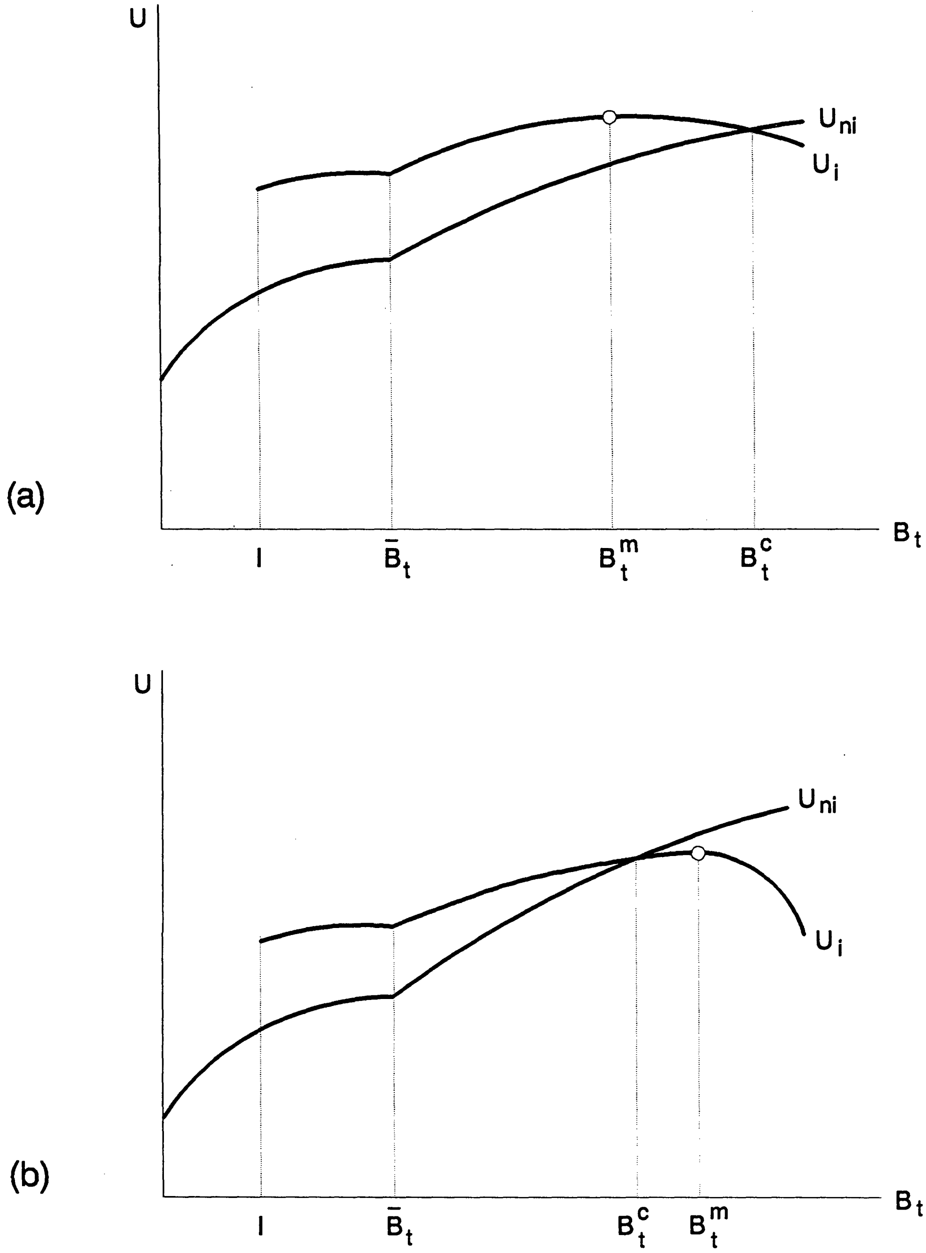

FIGURE 1

We now introduce two new variables, B_t^m and B_t^c. Let B_t^m be the amount of borrowing which maximizes utility in case of investment in human capital. The first order condition which determines B_t^m is

(17) $$u'(B_t^m - I) = \beta(1 + r^*)v'\{[\bar{W} - T_{t+1} - B_t^m(1 + r^*)]p^{-1}\}.$$

B_t^c is the amount of borrowing at which the U_i^t and U_{ni}^t curves intersect, and is determined by

(18) $$u(B_t^c) = u(B_t^c - I) + \beta p v\{[\bar{W} - T_{t+1} - B_t^c(1 + r^*)]p^{-1}\},$$

which is equivalent to equality in equation (10), the incentive compatibility constraint. Both B_t^m and B_t^c exist and are greater than $\bar{B}_t$, due to the assumptions made above.[12]

We can now classify the economy in the following way. If $B_t^m \leq B_t^c$ the incentive compatibility constraint is not binding and the young borrow B_t^m. This situation is described in Figure 1a. If on the contrary $B_t^m > B_t^c$ the incentive compatibility constraint is binding. This is described in Figure 1b. In this case the young invest in human capital too, but they cannot borrow all the amount they want but only B_t^c. Hence in this case the young are credit rationed by lenders, in order to avoid moral hazard. The economy can therefore be in one of two possible regimes: credit rationing, when $B_t^m > B_t^c$, or unconstrained credit, when $B_t^m \leq B_t^c$.

We can now fully describe the equilibrium in this economy. The equilibrium amount of the borrowing is

(19) $$B_t = \min(B_t^m, B_t^c).$$

The equilibrium amount of lending is

(20) $$L_t = pL\{[\bar{W} - T_t - B_{t-1}(1 + r^*)]p^{-1}\}.$$

Net foreign debt of this economy FD_t is determined by both borrowing and lending.

(21) $$FD_t = D_t + B_t - L_t,$$

and it determines the current account CA_t:

(22) $$CA_t = FD_{t-1} - FD_t,$$

and the trade balance TB_t:

(23) $$TB_t = CA_t + FD_{t-1} \cdot r^*.$$

In the next sections we examine this equilibrium more closely and in particular how it is affected by fiscal policy changes. We examine separately the two regimes, of constrained and unconstrained credit, and realize that they differ significantly.

5. FISCAL POLICY WHEN CREDIT IS NOT RATIONED

Let us now consider an economy in which credit is not rationed and the young can borrow the optimal amount B_t^m. Initially, the government runs a fixed fiscal

[12] $B_t^m \leq (\bar{W} - T_{t+1})/(1 + r^*)$ since greater borrowing leads to default in all cases. Notice that at $(\bar{W} - T_{t+1})/(1 + r^*)$ we have $U_i^t < U_{ni}^t$. Hence, B_t^c exists and satisfies: $B_t^c < (\bar{W} - T_{t+1})/(1 + r^*)$.

policy, where the budget is balanced: $D_t = D$, $T_t = T$ and $G_t = G = T - r^* \cdot D$. It is obvious from equations (17) and (20) that under such a policy the optimal amounts of borrowing and lending do not change from period to period. Hence, net foreign debt remains fixed, and the current account is balanced.

We now turn to analyze a change in fiscal policy. Consider a temporary fiscal expansion, which is debt financed. Government consumption is increased by δ in period t and δ is financed by a rise in debt from D to $D + \delta$ in period t. The additional debt and interest are paid back in period $t + 1$ and are then financed by a temporary increase in taxes of $(1 + r^*)\delta$. Hence, from period $t + 2$ on the government returns to its original fiscal policy. It is therefore clear that this change in policy does not have a lasting effect, but as we show next, it does create a short-run current account deficit.

In period t the young learn that they are going to pay higher taxes in period $t + 1$ and hence they reduce their borrowing. Since they are smoothing consumption over time, they reduce borrowing by less than the discounted amount of tax rise. Hence B_t^m is reduced by less than δ. This if formally shown in Lemma 1.

LEMMA 1. *If taxes rise in period $t + 1$ from T to $T + \delta(1 + r^*)$, optimal borrowing B_t^m is reduced by less than δ.*

PROOF. Let us examine equation (17) which determines B_t^m. If T_{t+1} rises, the RHS of (17) rises too and hence B_t^m must be reduced in order to restore equality in (17).

It B_t^m is reduced by δ then the RHS of (17) is the same as before the tax change, while the LHS is higher, as B_t^m is reduced. Hence, B_t^m cannot fall so much. Therefore, optimal borrowing B_t^m is reduced, but by less than δ. Q.E.D.

In period t, when the change in fiscal policy occurs, it does not affect grown-ups and old and hence L_t remains unchanged: $L_t = L_{t-1}$. Public debt rises by δ, borrowing is reduced by less than δ according to Lemma 1 and hence foreign debt rises, as

$$FD_t = D_t + B_t^m - L_t > FD_{t-1}.$$

The economy therefore experiences a current account deficit in period t, as $CA_t = FD_{t-1} - FD_t < 0$. It is easy to show that the trade balance deteriorates too in period t. As for following periods: period $t + 1$ experiences an increased trade balance and so does period $t + 2$ due to lower consumption by grown-ups and old.

Hence, if credit is not rationed this economy reacts to a debt financed fiscal expansion according to the standard Mundell–Fleming result. Such a fiscal expansion leads to a current account deficit on impact. Hence, as long as credit is not rationed, this economy behaves according to the conventional theory of open economies: the crowding out of consumption is less than full and a current account deficit emerges.

6. FISCAL POLICY UNDER CREDIT RATIONING

In this section we consider an economy in which the incentive compatibility constraint is binding, and the amount of borrowing by the young is determined by

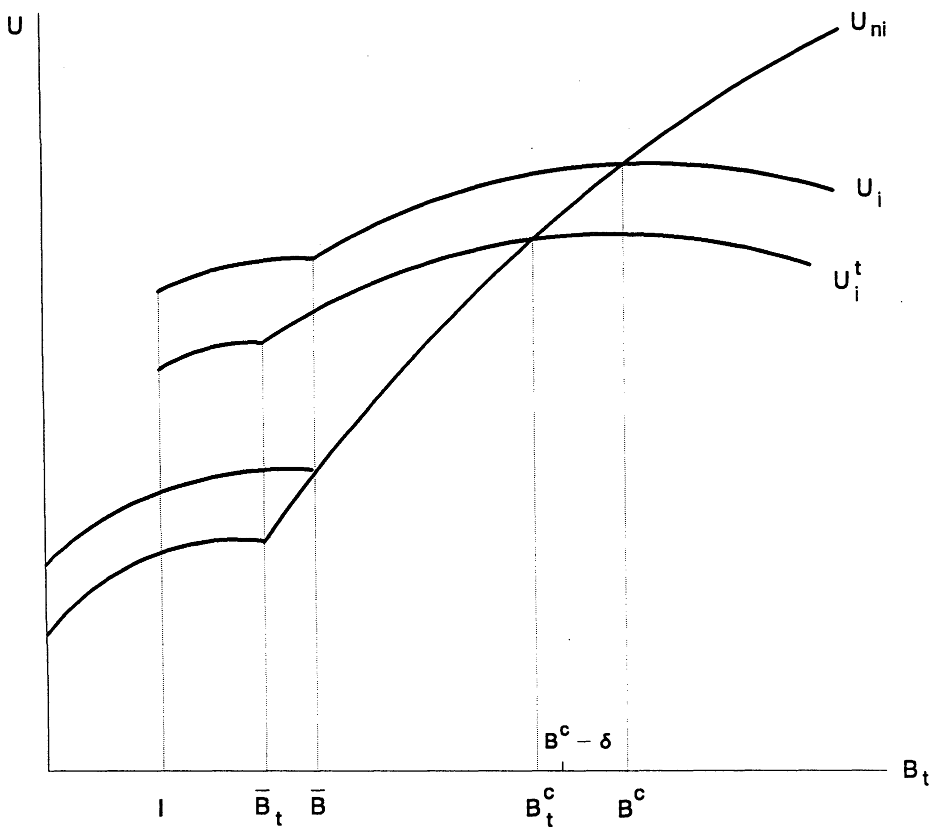

FIGURE 2

this constraint. Thus credit is rationed and the young can borrow only an amount B_t^c. Within such an economy let us consider the same temporary debt financed fiscal expansion, which is analyzed in Section 5. Hence, government demand and public debt temporarily rise by δ in period t, while taxes rise by $\delta(1 + r^*)$ in period $t + 1$.

Similar to the economy without credit rationing, the amount of lending by grownups in period t is not affected by the change in fiscal policy, since they pay the same amount of taxes. As for the amount of borrowing by the young we should examine how the incentive compatibility constraint is affected by the fiscal expansion. It is clear that while U_{ni} is unaffected by the rise in period $t + 1$ taxes (in this domain), the utility in case of investment U_i falls, as shown in Figure 2, from U_i to U_i^t. Hence, B_t^c is reduced and the young can borrow less. The reason for that is as follows: lenders know that borrowers will pay higher taxes in the future and gain less when successful, and hence may decide not to invest in human capital. Thus lenders are ready to lend only a smaller amount. Furthermore, we show in the following proposition that lending to the young is reduced by more than the discounted increase in taxes.

PROPOSITION 1. *If taxes in period $t+1$ are expected to rise by $\delta(1+r^*)$, borrowing B_t^c falls by more than δ.*

PROOF. Since both u and v have continuous derivatives we can calculate $\partial B_t^c/\delta T_{t+1}$ from equation (18) and get

$$\frac{\partial B_t^c}{\partial T_{t+1}} = -\frac{\beta v'}{(1+r^*)\beta v' + u'(B_t^c) - u'(B_t^c - I)}.$$

Since $u'(B_t^c) < u'(B_t^c - I)$ we get

$$\frac{\partial B_t^c}{\partial T_{t+1}} < -\frac{1}{1+r^*}.$$

Hence, if T_{t+1} rises by $\delta(1+r^*)$, B_t^c falls by more than δ. Q.E.D.

Proposition 1 can be demonstrated diagrammatically as well, by use of Figure 2. The rise in taxes shifts the U_i curve downward, from U_i to U_i^t. If B^c is the amount of borrowing before the change, then at $B^c - \delta$ we still have $U_i^t(B^c - \delta) < U_{ni}^t(B^c - \delta)$, as is clear from equation (18). It therefore follows from Figure 2 that $B_t^c < B^c - \delta$.

Proposition 1 therefore implies that the crowding out of consumption by the young is larger than the rise in public expenditures. This can be explained by the fact that individuals no longer smooth their consumption streams, as they are credit constrained. The rise in future taxes reduces the credit they can obtain by a large amount, since higher future taxes make investment in human capital much less profitable and significantly increase the possibility of moral hazard.

We can now examine the changes in the current account in this economy as a result of a fiscal expansion. In period t public debt D_t rises by δ, B_t falls by more than δ and L_t remains unchanged. Thus net foreign debt FD_t falls and $FD_t < FD_{t-1}$. Hence, the current account runs a surplus: $CA_t > 0$. This is a result of a huge crowding out effect, which exceeds the size of the increase in public demand. In periods $t+1$ and $t+2$ the economy runs a trade balance deficit, due to increased consumption of grown-ups and old, and then it returns to the initial steady state. We can therefore summarize this section by the following theorem.

THEOREM 1. *In an economy under credit rationing, where $B_t^c < B_t^m$, a temporary debt financed fiscal expansion creates a current account surplus on impact, and the Mundell–Fleming result does not hold.*

7. THE TAX BURDEN AND CREDIT RATIONING

As the above analysis demonstrates, an economy where credit is rationed reacts differently to fiscal policy changes than an economy without rationing. It is therefore interesting to try to characterize when credit is rationed and when it is not.

Consider the economy described in this model with a stable fiscal policy, described by: $T_t = T$, $D_t = D$ and $G_t = T - r^* \cdot D$, for all t. We wish to examine how this fiscal policy can affect the credit regime of the economy. Notice that of all the fiscal variables, B_t^m and B_t^c depend on the tax level T only, as can be seen in equations (17) and (18). Furthermore, if T rises by ε, we know from Lemma 1 that B^m falls by less than $\varepsilon/(1 + r^*)$ and we know from Proposition 1 that B^c falls by more than $\varepsilon/(1 + r^*)$. Hence, $B^m - B^c$ increases as T rises. Let T^* be the amount of taxes where: $B^m = B^c$. We assume that the parameters of the model guarantee the existence of T^*. Then for $T \leq T^*$ we have: $B^m \leq B^c$ and for $T > T^*$: $B^m > B^c$, as $B^m - B^c$ is an increasing function of T. Hence the tax burden T determines whether credit is rationed in the economy or not and we get the following theorem.

THEOREM 2. *If at T^* we have: $B^m = B^c$, then for $T \leq T^*$ credit is not rationed and the Mundell–Fleming result holds, while for $T > T^*$ credit is rationed and the Mundell–Fleming result is reversed.*

According to Theorem 2 the tax burden determines whether the current account is positively or negatively correlated with fiscal policy.

8. DISCUSSION

In this section we discuss both the assumptions and the results of our model, in order to examine their generality.

Fiscal Policy. Our comparison of economies with and without credit rationing concentrates on the effect of a specific type of policy change, namely a temporary debt financed fiscal expansion. We show that an economy with credit rationing reacts very differently to such a change compared to a standard economy, but this result is quite general and holds for all types of fiscal expansions, as long as they are financed by taxes somewhere in the future. This follows from Proposition 1, which claims that under credit rationing borrowing is reduced by more than the discounted value of the rise in taxes, while if credit is not rationed, it is reduced by less. Hence, we can deduce that in all types of fiscal expansions the current account deficit rises by less when credit is rationed, and may even be reduced. Hence, the result that credit rationing changes significantly the reaction of the economy to fiscal policy changes, is general and robust.

Fiscal Policy and Investment in Human Capital. The model which is presented in this paper describes one type of asymmetric information, with regard to investment in human capital. It is clear that alternative modelling of credit rationing would still yield similar results and show that indeed credit rationing alters the behavior of an open economy.[13] But the case of investment in human capital is especially interesting as it raises the issue of government participation in education. Notice that although the specific market failure in this economy is in the credit market, the government cannot directly intervene in this market by shifting income from

[13] In Zeira (1988) we show that credit rationing due to asymmetric information with regard to effort in work, yields similar results.

grown-ups to the credit constrained young borrowers, since then no one would invest in human capital and everyone will default, as the government faces the same asymmetric information problem that lenders do. But the government can directly supply education, and so increase investment in human capital. Although such a policy cannot fully eliminate the moral hazard problem, it can sufficiently reduce it for the economy to move from the credit rationing regime to the nonrationing regime.

This observation is important mostly when we wish to examine the empirical validity of Theorem 2. If the government raises taxes but uses it to finance education and investment in human capital, it may reduce credit rationing in the economy rather than increase it. That may be the reason why a country like Sweden has a positive correlation between its fiscal policy and the current account, even though it has a very high tax burden.

Hence, if investment in human capital by the government is possible, Theorem 2 may not always hold. But we still have the following general result: the correlation between the current account and fiscal policy depends on fiscal policy itself, on the tax burden and on the degree of government involvement in education.

9. SUMMARY

This paper is part of a growing literature, which examines macroeconomic implications of endogenous credit market's imperfections, due to asymmetric information or to various types of information costs. This literature, which is relatively new, has already demonstrated that credit markets' imperfections are relevant for many macroeconomic issues. Blinder and Stiglitz (1983), Mankiw (1986), Bernanke and Gertler (1989, 1990) and Sussman (1989) examine the effects of credit markets on economic fluctuations. Tsiddon (1989) discusses the effects of credit rationing on economic growth and Galor and Zeira (1989) show that if credit markets are imperfect, the distribution of wealth becomes an important macroeconomic variable.

Surprisingly, there are very few works which examine the effects of such credit markets' imperfections on open economies.[14] It is surprising since credit markets affect borrowing and lending, which determine net foreign debt and the current account. Thus credit markets significantly affect issues, which are at the heart of any macroeconomic discussion of the open economy. This paper indeed shows that the presence of credit market imperfections significantly changes the analysis of open economies. It is therefore our belief that more research should be directed at this issue of open economies under credit markets imperfections, especially if we think that in the real world credit markets are indeed far from being perfect.

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[14] Although there are many studies that examine constraints on sovereign debt, within the country risk literature, there are very few works which discuss credit constraints as a decentralized market phenomenon in open economies, as this paper does. Two recent studies within this line of research are Greenwood and Williamson (1989) and Gertler and Rogoff (1989).

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