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COUNTRY RISK, ASYMMETRIC INFORMATION AND DOMESTIC POLICIES

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ABSTRACT

This paper describes an economy where incomplete information regarding the default penalty can result in an upward-sloping supply of credit. We evaluate the role of partial information and other related factors in determining the elasticity of supply of credit and the credit ceiling facing the economy. We identify conditions under which the presence of country risk induces a domestic distortion. Next, we derive the cost-minimizing domestic policies needed in the presence of such a distortion. It is shown that cost-minimizing policies for a country that wishes to service its debt in the presence of country risk calls for a combination of borrowing taxes and time varying consumption taxes. If all consumers have access to the domestic capital market, the two policies are equivalent. If domestic consumers are subject to liquidity constraints, cost-minimizing policies call for a combination of time varying consumption taxes and product subsidies that will mimic the consumption distribution achieved by cost-minimizing policies in the absence of liquidity constraints. The policies derived in the paper are formulated in terms of the country risk, as embodied in the elasticity of supply of credit facing the borrower. In a mixed economy, where some consumers are subject to credit rationing whereas others have full access to the domestic credit market, there is a need for taxes on borrowing as well as time varying consumption and production tax cum subsidies. The analysis also shows that if the level of external borrowing is substantial, cost-minimizing domestic policies call for instituting a two-tier exchange rate system.

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In the 1980's a growing number of countries have found servicing their debt a challenging task. Countries in balance of payments crises have tended to impose restrictions on capital mobility, and have adopted various versions of two-tier exchange rate systems. The growing policy concern with balance of payments crises has also been reflected in considerable interest in the factors governing country risk[1] and in the role of two-tier exchange rate systems as means of restricting capital flows.[2] The purpose of this paper is to integrate these two lines of research by analyzing the design of cost-minimizing domestic policies in the presence of country risk. This paper derives the characteristics of the supply of credit in a stochastic environment. The analysis identifies the considerations under which country risk introduces a domestic distortion. These considerations facilitates the derivation of the cost-minimizing policies needed to deal with the distortion. To add a dimension of reality we also examine the effect of an imperfect domestic capital market on the cost-minimizing policies. Hence, we specify the cost-minimizing policies applicable to situations with perfect domestic capital market as well as to situations in which the capital market is subject to credit rationing.

Section I formulates a two periods model. Borrowing occurs in period zero before the realization of the stochastic shocks, and debt repayment is scheduled for period one. In case of default, a default penalty is inflicted upon the borrower. We derive the supply of credit offered by the lender. The elasticity of the supply of credit is shown to be determined by the degree of uncertainty about the size of the (stochastic) default penalty. For "mild" degree of uncertainty the supply of credit is perfectly elastic up to a credit ceiling. On the other hand if the uncertainty is substantial, the supply schedule is composed of three portions. It is perfectly elastic (at the world risk-free rate of interest) for small levels of credit, it is upward sloping for intermediate credit levels (until the credit ceiling is reached) and it is completely inelastic at the credit-ceiling level. It might even include a backwards-bending portion emerging from the credit-ceiling level. The elasticity of the supply of credit along the upward sloping portion is shown to rise with the magnitude of the penalty relative to the credit volume. This elasticity depends negatively on the interest rate. The analysis also identifies the factors determining the level of the credit ceiling.

In section II we show that if the equilibrium occurs along the upwards sloping portion of the supply of credit then it results in a domestic distortion (for a related analysis see Harberger (1980)). This situation provides the rationale for government intervention . The distortion arises from the fact that individual borrowers treat the rate of interest as given even though from the perspective of the country as a whole the rate of interest rises with the volume of borrowing. The fact that individual borrowers do not take account of the rising supply curve implies that from the social point of view the equilibrium is associated with "excess" borrowing. The welfare cost induced by the distortion can be eliminated through policies that reduce the amount of aggregate borrowing. For such policies to be effective they need to raise the relevant intertemporal cost of current spending. Such a rise in the intertemporal cost can be achieved by either a tax on international borrowing, or by a time varying consumption tax (tilted towards the present) or by a combination of the two. With perfect domestic capital markets, the two policies are equivalent. These policies internalize the distortion, created by the "semi monopsony" situation in the financial market. If the level of external borrowing is substantial (that is, if it approaches the credit limit level), then the cost-minimizing domestic policies are equivalent to the adaption of a two-tier exchange rate system. Such policies amount to a combination of a quota on borrowing (equal to the credit ceiling) and a borrowing tax. This tax equals the percentage spread between the domestic interest rate ("the demand price") and the foreign interest rate ("the supply price") at the ceiling. This policy captures the 'quota rent' generated in the presence of credit rationing and prevents the possibility of an inefficient equilibrium along the backward-bending portion of the supply of credit.

The substitutability of borrowing taxes with time varying consumption taxes as cost-minimizing policies is a consequence of the perfect domestic capital market assumed in section II. In section III we will relax this assumption, considering the case where domestic consumers are subject to credit rationing. Cost-minimizing policies are shown to involve time varying consumption and production taxes and subsidies at a rate that will imply an intertemporal transfer of income. This transfer will allow consumers to enjoy the cost-minimizing allocation of consumption that is attainable with access to the capital market. A "loan" is granted where subsidies exceed taxes; and a loan is "serviced" when taxes exceed subsidies. In a way, the authorities are providing the financial intermediation services of a bank. Cost-minimizing policies allow the indirect participation of consumers subject to credit rationing in the financial market. The economic justification for such a role for the public sector is the presumption that authorities may have a cost advantage over banks in the provision of financial intermediation for risky consumers. This is because the authorities can force consumers to service their debt by imposing a needed set of consumption taxes. In general, the presence of limited domestic financial integration destroys the equivalence between borrowing taxes and time varying consumption taxes, putting a greater weight on the second set of policies. Section IV closes the paper with concluding remarks.

I. Country Risk and Incomplete Information

This section provides an example of the economic factors determining the supply of credit. We consider a small economy where there is partial information regarding the costs of default. Debt issuance occurs before the resolution of uncertainty. Thus, the lender determines the supply of credit based upon his partial information. The elasticity of the supply of credit will be shown to be determined by the nature of uncertainty regarding the borrower's myopia and the penalty size.

Consider a two periods horizon. Borrowing B takes place in period zero, at a rate r^*. Debt repayment is scheduled for period one. In case of default a penalty of N/Ψ is inflicted upon the borrower. The partial information stems from the assumption that the lender has only incomplete information regarding Ψ. A possible economic interpretation of Ψ is as the discount factor applied for a penalty to be inflicted in the future (period two). Let N be the cost of being excluded from the international credit market in the future due to a default in period 1; and Ψ be the effective discount factor that translates the future penalty (N) into N/Ψ in terms of period one. Thus, Ψ can be viewed as a myopia measure, where a higher Ψ corresponds to a smaller weight attached to the future. For example, if the default decision is determined by a party whose political horizon is limited, Ψ will reflect the myopia of the decision maker. Alternatively, the analysis can apply for the case of partial information regarding the size of the penalty N: let the default penalty (N) be proportional to output (or export) in period one. The term Ψ may reflect a stochastic productivity term.

Default will take place if the penalty falls short of the debt.[3]

$$(1) \qquad (1 + r^*) B > N/\Psi$$

or, in logarithmic notation, if

(2) $$n - \tilde{r}^* - b < \psi \quad , \text{ where}$$

$b = \log B$; $\psi = \log \Psi$, $n = \log N$, $\tilde{r}^* = \log (1 + r^*)$

The lender's information regarding ψ is summarized by a distribution. To gain tractability we assume an exponential distribution:

(3) $$\psi = \psi_0 + \tau \quad , \text{ where } \quad 0 \le \tau \le \varepsilon$$

and the density function of τ is

(4) $$f(\tau) = \begin{cases} \dfrac{e^{-\tau}}{1 - e^{-\varepsilon}} & \text{for } 0 \le \tau \le \varepsilon \\ 0 & \text{for } \tau < 0 \text{ or } \varepsilon < \tau \end{cases}$$

As $\varepsilon \to 0$, we approach the case of full information regarding the default penalty. With complete information $(\varepsilon = 0)$, default will take place only if $B > N/[(1 + r_f^*)\Psi_0]$, where $\Psi_0 = e^{\psi_0}$ and r_f^* is the risk free interest rate. Thus, in such a case the borrower will face a supply of credit given by abc (Figure 1), where B_H is the credit ceiling. We assume that the borrowing country is small. Thus, in the absence of risk it faces an elastic supply of credit, at the risk free rate (r_f^*).

Let us consider now the case of uncertain ψ (i. e., $\varepsilon > 0$).[4] In general, equation 1 implies that for values of B smaller than $B_L = N/[(1 + r_f^*)\, \Psi_0 e^{\varepsilon}]$ the default probability is zero, because $\Psi \le \Psi_0 e^{\varepsilon}$. Thus, the supply of credit is elastic till B_L. For $B > B_L$ we expect positive incidence of default. Thus, for $B > B_L$ we expect $r^* > r_f^*$, because a risk neutral lender will demand interest r^* such that

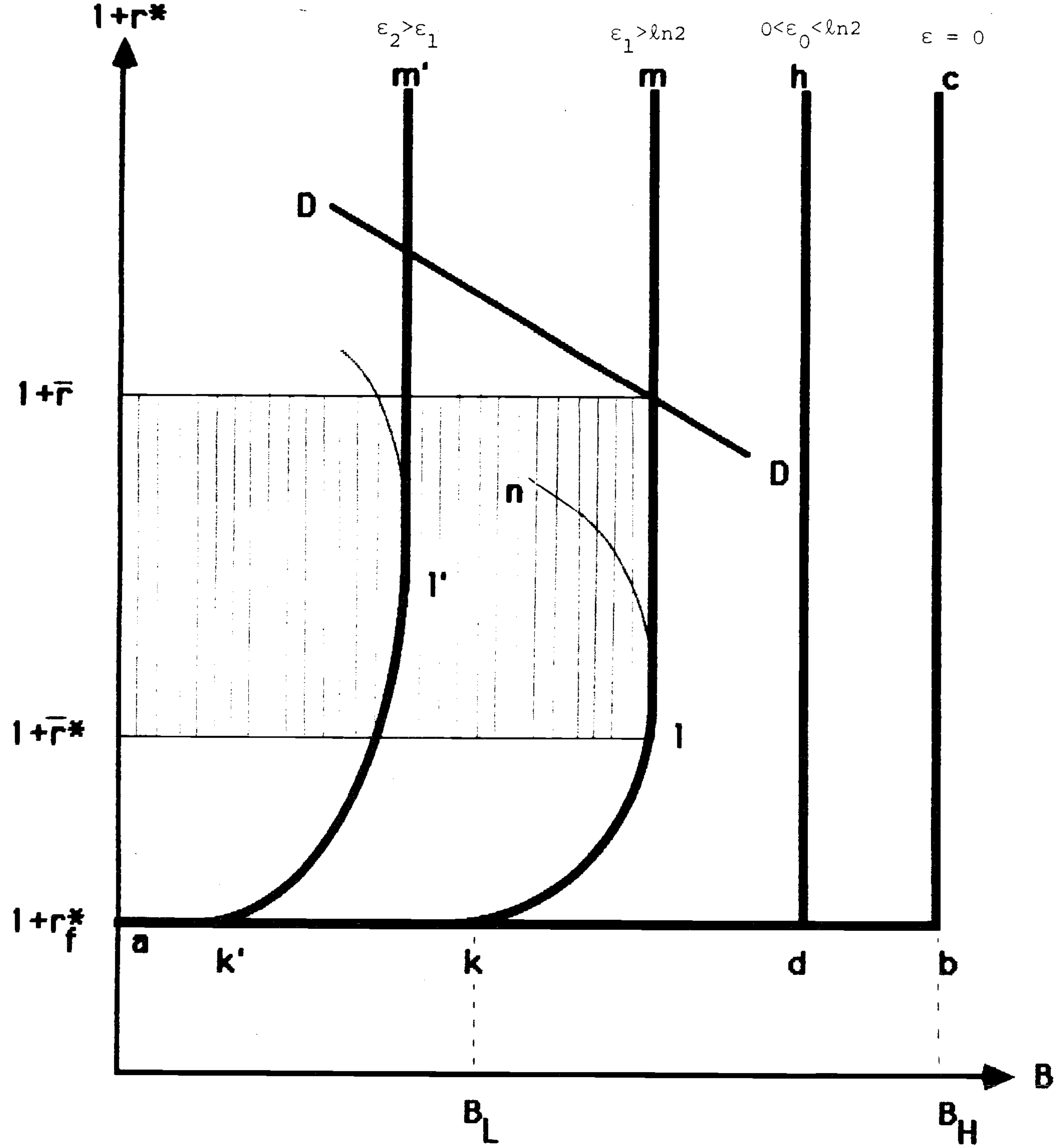
1+r*
$\varepsilon_2 > \varepsilon_1$
$\varepsilon_1 > \ell n2$
$0 < \varepsilon_0 < \ell n2$
$\varepsilon = 0$
m'
m
h
c
D
D
n
1'
1
$1+\bar{r}$
$1+\bar{r}^*$
$1+r_f^*$
a
k'
k
d
b
B
B_L
B_H

FIGURE 1

$$(5) \qquad (1 + r^*)P = 1 + r_f^*$$

where P is the probability of no default $(P = P((1 + r^*)B))$. Equation 5 defines the supply of credit. It implies that along the supply of credit

$$(6) \qquad \frac{d \log B}{d \log (1 + r^*)} = \frac{1 - \eta}{\eta} \qquad \text{where } \eta = - \frac{d \log P}{d \log[(1 + r^*)B]} > 0 .$$

Notice that for $0 \leq \eta < 1$ the supply of credit is either elastic or upward sloping. For $\eta > 1$ the supply of credit bends backwards. Maximization implies that the borrowing country will not operate on the backward bending portion of the supply of credit.[5] Thus, a credit ceiling is reached when $d \log B/d \log (1 + r^*) \leq 0$. To conclude the specification of the supply schedule, let us determine the credit ceiling, denoted by $\bar{B}$. In general, we should distinguish between two cases. If B_L is on the backward bending part of the supply curve (defined by equation 5), then $\bar{B} = B_L$ (recall that B_L is the largest B that is consistent with $P = 1$) . Otherwise, the credit ceiling is reached when $\eta = 1$ (or, equivalently, when $d \log B/d \log (1 + r^*) = 0$). In terms of our example, the supply curve is defined by:

$$(7) \qquad (1 + r^*) \, P[\tau < n - b - \tilde{r}^* - \psi_0] = 1 + r_f^*$$

where $P[\tau < n - b - r^* - \psi_0]$ is the probability of repayment. Using (4) this probability is given by

$$(8) \quad P[\tau < n - b - \tilde{r}^* - \psi_0] = \begin{cases} 1 & \text{for} \quad B_L > B \\ \left[1 - \frac{B(1 + r^*)\Psi_0}{N}\right] \frac{1}{1 - e^{-\varepsilon}} & \text{for} \quad \bar{B} \geqslant B > B_L \end{cases}$$

where $\bar{B}$ stands for the debt ceiling.

Thus, for $\bar{B} > B > B_L$ the interest rate r^* is defined by

$$(9) \qquad (1 + r^*) \left[1 - \frac{B(1 + r^*)\Psi_0}{N}\right] = (1 + r_f^*)\ (1 - e^{-\varepsilon})$$

Equation (9) implies that[6]

$$(10) \qquad \frac{d \log B}{d \log (1 + r^*)} = \begin{cases} \infty & B < B_L \\ \dfrac{N}{(1 + r^*)\Psi_0 B} - 2 & B_L < B < \bar{B} \\ 0 & \bar{B} = B \end{cases}$$

Applying this information to (9) it follows that the credit ceiling ($\bar{B}$) and the corresponding interest rate ($\bar{r}^*$) are[7]:

(11)

$$[\bar{B};\ \bar{r}^*] = \begin{cases} \left[\dfrac{N}{(1 + r_f^*)\ \Psi_0 e^{\varepsilon}};\ r_f^*\right] & \text{for } 0 \le \varepsilon \le \ln (2) \text{ and} \\ \left[\dfrac{N}{(1 + r_f^*)\Psi_0(1 - e^{-\varepsilon})4};\ (1 + r_f^*)(1 - e^{-\varepsilon})2 - 1)\right] & \text{for } \varepsilon \ge \ln (2). \end{cases}$$

These characteristics of the supply of credit are summarized in figure 1. The case of full information ($\varepsilon = 0$) corresponds to abc. Positive values of ε, but smaller than $\ell n\ 2$, are associated with a supply schedule adh. Finally, for $\varepsilon > \ell n\ 2$ the supply schedule becomes aklm. A higher value of ε reduces the credit ceiling, as reflected by schedule ak'l'm'. The elasticity of the supply of credit along the upward sloping portion kl is given by equation (10). Higher values of the interest rate and of the myopia index (ψ_0) are associated with higher credit-supply elasticity. Likewise, the elasticity rises with the ratio of the penalty (N) relative to the volume of credit.

The determinants of the credit ceiling can be summarized by

(12) $$\bar{B} = B(\varepsilon,\ \psi_0,\ r_f^*) \quad \text{where}$$

(13) a. $\frac{\partial \bar{B}}{\partial \psi_0} < 0$ b. $\frac{\partial \bar{B}}{\partial r_f^*} < 0$ c. $\frac{\partial \bar{B}}{\partial \varepsilon} < 0$

In general, a higher myopia index $(d\psi_0 > 0)$, a higher risk-free interest rate and a higher uncertainty concerning the penalty of default $(d\varepsilon > 0)$ are associated with a lower credit ceiling. Our analysis has demonstrated that the degree of uncertainty plays an important role in the determination of the supply of credit. For "mild" uncertainty (that is, for $\varepsilon < \ln 2$) the supply of credit is elastic for credit levels below the ceiling. If the uncertainty exceeds a certain threshold $(\varepsilon > \ln 2)$, the supply of credit is upward sloping for a credit volume that is below the ceiling $(B_L < B < \bar{B})$.

While our discussion has been conducted for a special distribution, the main results apply for a general distribution. For example, let $f(\psi)$ denote a general distribution of ψ. It can be shown that the elasticity of the probability of no default with respect to indebtedness (η) equals to

(6') $$\eta = f(\psi)/F(\psi)$$

where $F(\psi) = \int_{-\infty}^{\psi} f(y)dy$ is the cumulative distribution of f. Equation (6') reveals that the shape of the supply of credit is determined by the characteristics of the distribution f. It is backwards-bending for values of $B(1 + r^*)$ that satisfy the condition that $f\,[\log\,(N/(B(1 + r^*)))] > F[\log(N/(B(1 + r^*)))]$. It can be shown that a large class of the distributions $f(\psi)$ (including the normal distribution) yields a supply of credit of the type reported in Figure 1--a supply curve that is perfectly elastic for small level of credit (at the world risk-free rate of interest), is backward-bending for large enough r^*, and the elasticity of supply drops with the interest rate. Furthermore, the main arguments made in the subsequent analysis are independent of the shape of $f(\psi)$.

In the next section we derive the cost minimizing domestic policies for a small economy operating along the upward sloping portion of the supply of credit.

II. Optimal Domestic Policies

The purpose of this section is to derive optimal domestic policies in the presence of the supply characterized by (5). It is useful to start with a real model, because the design of the optimal policies can be shown to be independent of monetary considerations. Consider a one-good open economy that faces given international prices. Let the utility of a representative consumer be given by

$$U = u(X_0) + \rho u(X_1) \tag{14}$$

where ρ stands for the subjective rate of time preference and X_i is the consumption at time i. The domestic interest rate, r, is defined by

$$r = r^*(1 + \alpha) \tag{15}$$

where r^* is defined by the supply of credit (5) and α is the domestic tax on borrowing. We assume that the country is a net debtor in period zero, thus equation (15) defines the domestic interest rate. Let δ, δ^* denote, respectively, the discount factors gross and net of borrowing taxes ($\delta = 1/(1 + r)$; $\delta^* = 1/(1 + r^*)$). The authorities can use consumption taxes and subsidies, as well as borrowing taxes. The private-sector budget constraints are

$$(1 + \theta_0)X_0 = \bar{X}_0 + B + R_0 \tag{16a}$$

$$B(1 + r) + (1 + \theta_1)X_1^n = \bar{X}_1 \tag{16b}$$

$$X_1^d = \bar{X}_1 - \frac{N}{\Psi} \tag{16c}$$

where (θ_0, θ_1) are the consumption taxes in periods 0 and 1, (X_1^d, X_1^n) is consumption in period one for the case default and no default, respectively; $(\bar{X}_0, \bar{X}_1)$ is the endowment, R_0 is the transfer in period 0 and we assume that foreign prices are one. Equations (16b) and (16c) are the budget constraints for period one for the case of no default and default, respectively. To simplify exposition, we assume that θ_1 is applied only in case of no default. Combining (16a) and (16b) yields an intertemporal budget constraint:

$$(1 + \theta_0)X_0 + \delta(1 + \theta_1)X_1^n = \bar{X}_0 + \delta\, \bar{X}_1 + R_0 \tag{17}$$

The specification of the budget constraint embodies the notion that the consumer is the owner of the claims on output $(\bar{X}_0, \bar{X}_1)$.

The consumer's problem is to allocate consumption so as to maximize his expected utility subject to the budget constraint. Let V denote the value of the expected utility. In computing this value, the expectations are taken in period zero, based upon the information regarding the distribution of Ψ, denoted by $g(\Psi)$. Let the ratio $N/[B(1 + r^*)]$ be denoted by Z. It follows that

$$V = u(X_0) + \rho\left[\int_{-\infty}^{Z} u(X_1^n)g(\Psi)d\Psi + \int_{Z}^{\infty} u(\bar{X}_1 - N/\Psi)g(\Psi)d\Psi\right] \tag{18}$$

Thus V is a function of three argumets:

$$V = V(X_0, X_1^n, Z) \tag{19}$$

In maximizing V subject to the budget constraint (17), the consumer chooses in period zero the values of X_0 and X_1^n. This maximization yields the first order conditions (20)-(21):

(20) $$V_{X_0} = \lambda(1 + \Theta_0)$$

(21) $$V_{X_1^n} = \lambda\delta(1 + \Theta_1),$$

where λ is the multiplier associated with the budget constraint (17) and $V_y = \frac{\partial V}{\partial y}$ for any y. In deriving these first-order conditions, we are using the fact that each consumer treats r as given. As the subsequent analysis reveals this price-taker behavior brings about a distorted domestic equilibrium.

To close the model, we specify the supply of credit facing the small country. The determination of the interest rate is represented by a negative functional dependency between the net discount factor (δ^*) and the level of indebtedness:

(22) $$\delta^* = \delta^*(B(1 + r^*)) \quad , \quad (\delta^*)' < 0.$$

Equation (22) is a reduced form equation, which is derived from (5). Notice that equation (6) implies that

(23) $$\frac{d \log B}{d \log \delta^*} = - \frac{1 - \eta}{\eta}$$

where η was defined in (6).

The value of η reflects the degree of integration of the domestic economy with the international financial market. Equation (23) implies that as η approaches unity, the economy approaches a credit ceiling under which a further rise in the interest rate r^* does not increase the credit offered to the country. Alternatively, as η approaches zero we approach the case of full integration, where the country risk factor is absent. Therefore, a value of η that is close to one reflects a high degree of financial segmentation of the domestic economy. For the purpose of our discussion we take η as given, focusing on the design of optimal domestic policies.

The set of optimal policies is derived in two stages. First, we derive the change in the expected utility of a representative consumer due to a revenue-neutral change in taxes. We then apply this expression to compute the implied restrictions on optimal policies. To simplify, we neglect the role of the public sector; hence we assume that the net revenue of all taxes and transfers is zero. Thus, the economy-wide budget constraint implies that:[8]

$$[X_0 - \bar{X}_0] + \delta^*[X_1^n - \bar{X}_1] = 0 \tag{24}$$

Equation (24) reflects the fundamental budget constraint: using the external prices, net present value of borrowing is zero. In general, the marginal change in welfare can be approximated by

$$\frac{\Delta V}{V_{X_0}} = \Delta X_0 + \Delta X_1^n \frac{V_{X_1^n}}{V_{X_0}} + \Delta Z \frac{V_Z}{V_{X_0}} \tag{25}$$

Applying the first order conditions (20)-(21) to (23) and the fact that $V_Z = 0$ yields

$$\frac{\Delta V}{V_{X_0}} = \Delta X_0 + \frac{1 + \theta_1}{1 + \theta_0} \delta \Delta X_1^n \tag{26}$$

The economy-wide budget constraint (24) and the supply of credit (22) imply that the net present value of changes in net borrowing in both periods should add up to zero, where the relevant discount factor is the social discount factor, $\delta^*(1 - \eta)$:

$$\Delta(X_0 - \bar{X}_0) + \Delta(X_1^n - \bar{X}_1)\delta^*(1 - \eta) = 0 \tag{27}$$

From equation (27) we infer a value of ΔX_0 . We substitute this value for ΔX_0 into (26), and obtain the final expression for the change in utility:

(28) $$\frac{\Delta V}{V_{X_0}} = [\frac{\delta(1 + \theta_1)}{1 + \theta_0} - \delta^*(1 - \eta)] \, \Delta X_1^n$$

Equation (28) is a reduced-form expression in which (as usual) the change in welfare is described as the sum of changes in quantities, weighted by the initial distortions(see Harberger (1971)). This expression is useful in assessing the set of optimal policies because optimality requires that the distortion (i.e., the coefficient of the quantity changes) should be set to zero.[9,10] Thus:

(29) $$\frac{\delta(1 + \theta_1)}{1 + \theta_0} = \delta^*(1 - \eta)$$

The presence of country risk calls for policies that equate the private intertemporal relative prices $\delta(1 + \theta_1)/(1 + \theta_0)$ to the social discount factor $\delta^*(1 - \eta)$. For <u>small</u> values of θ_0, θ_1, η, $r^*\alpha$ equation (29) implies that:

(29') $$\eta = \alpha r^* + \theta_0 - \theta_1$$

The targeted change in the intertemporal relative prices can be achieved by a <u>combination</u> of borrowing tax (αr^*) and uniform, time varying consumption taxes that are tilted towards the present $(\theta_0 - \theta_1 > 0)$. It is noteworthy that (29') applies only for small values of all the parameters. For example, (29) implies that as η approaches unity (as is the case in the presence of credit rationing), α approaches infinite.[11] At the limit $(\eta = 1)$, optimality calls for a quota on borrowing and a corresponding optimal borrowing tax. Notice that under a binding credit ceiling $(B = \bar{B})$ the domestic interest rate is demand determind, generating a 'rent'. This rent equals to $\bar{B}(\bar{r} - \bar{r}^*)$, where $\bar{r}$ is the interest rate that clears the domestic market for $B = \bar{B}$, and $\bar{r}^*$ is the interest rate charged by lenders when B is marginally below the credit ceiling $\bar{B}$. This argument is summarized in Figure 1. If the supply of credit is aklm, and the demand by D, the 'quota rent' is the shaded area in Figure 1. The optimal policy is a quota $\bar{B}$ and a borrowing tax α , where $\alpha = (\bar{r} - \bar{r}^*)/\bar{r}^*$. The tax is designed to capture the rent, preventing it from being captured by foreign lenders. This policy can be implemented in the form of a two-tier regime, where the domestic interest rate is endogenously determined by the spread between the financial and the commercial exchange rates. Thus, our analysis demonstrates that a two-tier exchange rate can be the outcome of an equilibrium response of the domestic authorities to credit rationing by foreign creditors--when a borrower approaches the inelastic portion of the supply of credit, optimality calls for a borrowing tax at a rate defined by the spread between the domestic and the foreign interest rate $((\bar{r} - \bar{r}^*)/\bar{r}^*)$. Note that as $\eta \to 1$ there is important role for the quota --to prevent an equilibrium along the backward bending portion of the supply of credit.[12]

Equation (29) implies that there is a redundancy of an instrument, in the sense that a tax on borrowing can be substituted by time varying uniform consumption taxes. This apparent redundancy reflects the assumption that all consumers have full access to the domestic financial market. We turn now to an analysis of optimal policies in the presence of credit rationing.

III. Liquidity Constraints

The previous section derived optimal policies in the presence of country risk for the case where consumers have full access to the domestic capital market. Sometimes, however, enough consumers face effective credit rationing to pose the question of what policies might be optimal in the presence of liquidity constraints. While the economic explanation for the extent to which credit rationing is binding is beyond the scope of the present paper, it is useful to make the following observations.[13] Countries subject to country risk tend to be countries in which the sophistication of their domestic credit market is limited. These countries also tend to apply for credit assistance during severe recessions. Both of the above conditions tend to be associated with the presence of credit rationing. Thus, it is desirable to assess the role of domestic policies for the case of country risk and liquidity constraints.

Suppose that the consumer described in Section II is facing credit rationing. As a consequence, he faces distinct periodic budget constraints, denoted by BC:

$$BC_0 = (1 + \theta_0)X_0 - \bar{X}_0 - R_0 = 0 \tag{19'a}$$

$$BC_1^n = (1 + \theta_1)X_1^n - \bar{X}_1 - R_1^n = 0 \tag{19'b}$$

$$BC_1^d = (1 + \theta_1^d)X_1^d - \bar{X}_1 = 0 \tag{19'c}$$

The terms R_0, R_1^n include terms related to the intertemporal transfer of income allowed by the existing level of credit offered to the consumer. What is relevant, however, is that at the margin our consumer is effectively rationed in the credit market. For simplicity of exposition, we consider the case where $R_0 = R_1^n = 0$. The public sector chooses the set of taxes cum subsidies as to maximize the expected utility of a representative consumer. Formally, this is equivalent to optimizing equation (18) subject to the budget constraint (24) and the external supply of credit (22). We can obtain the optimal policies by applying the two stages procedure used in section II. Notice that equation (25) still holds as a measure of the change in utility due to marginal change in policies. Note also that equation (27), the economy-wide budget constraint, is still valid. Applying (27) to (25) yields the final expression:

$$(30) \qquad \frac{\Delta V}{V_{X_0}} = [\phi - \delta^*(1 - \eta)]\ \Delta X_1^n \qquad \text{where } \phi = \frac{V_{X_1^n}}{V_{X_0}}$$

The restrictions on optimal policies are obtained by equating the coefficient in (30) to zero, yielding

$$(31) \qquad \phi = \delta^*(1 - \eta)$$

Equation (31) implies that intertemporal taxes should be imposed in such a way as to equate the ratio of private intertemporal marginal utilities of consumption (ϕ) to the social discount rate ($\delta^*(1 - \eta)$). This is also the condition that institutes the Ricardian equivalence proposition.[14] For small values of r^*, η, $\phi - 1$, we can approximate (31) by:

$$(31') \qquad \eta = 1 - \phi - r^*$$

A comparison of the conditions for an optimal path of taxes between the cases of liquidity constraint (31') and full access to the domestic financial market (29') reveals that liquidity constraints destroy the equivalence between time varying consumption taxes (and production subsidies) and taxes on borrowings. For a consumer subject to credit rationing, taxes on borrowing are not relevant because they do not affect his behavior. Thus, the presence of credit rationing implies that the optimal intertemporal allocation should be achieved via uniform, time varying consumption and production taxes and subsidies. The optimal set of policies would mimic the intertemporal allocation of consumption for a consumer with access to the domestic financial market. This can be accomplished by applying taxes cum subsidies as a means of intertemporal transfer of income. In designing such a policy, the public sector provides the intermediation services of a bank to consumers who are excluded from the credit market. A "loan" is granted where subsidies exceed taxes, and the loan is "serviced" when taxes exceed subsidies. The economic justification for such a role for the public sector is the implicit assumption that the authorities have a cost advantage over banks in the provision of financial intermediation for risky consumers. This is because the authorities can force consumers to service their debt by imposing a needed set of consumption taxes. Thus, the argument for the application of the optimal policies described above necessitates a sound fiscal system with the capacity to enforce taxes.

The above arguments are illustrated with the following Cobb-Douglas model. Let the utility of a representative consumer be given by:

(32) $$U = \log X_0 + \rho \log X_1$$

We consider now the case where the consumer lacks access to financial markets. If $(\bar{X}_0, \bar{X}_1)$ stands for the endowment vector, equation (18) implies that for the Cobb-Douglas case

(33) $$\phi = \frac{1 + \theta_1}{1 + \theta_0} \frac{\bar{X}_0}{\bar{X}_1} \rho P$$

Applying (33) to (31) yields the following condition for optimal policies:

(34) $$\frac{\rho \bar{X}_0}{\delta_f^* \bar{X}_1} = (1 - \eta) \frac{\theta_0 + 1}{\theta_1 + 1} \qquad \text{where } \delta_f^* = \frac{1}{1 + r_f^*} = \frac{\delta^*}{P}$$

For small values of η, θ_0, θ_1 we get

$$\log\,[\rho/(\delta_f^*\bar{X}_1/\bar{X}_0)] + \eta = \theta_0 - \theta_1 \tag{35}$$

The first term in (35) measures the endowment bias towards period zero. Note that with full access to financial markets, a consumer facing a discount rate δ_f^* will choose a consumption path such that $\delta_f^* X_1/X_0 = \rho$. Thus, if the first term is zero, the intertemporal distribution of endowment coincides with the desired distribution of consumption, whereas a negative value reflects an endowment bias towards period one. Equation (35) implies that the intertemporal path of net taxes is determined by country risk and by the endowment bias. Assuming that the design of taxes Θ_0, Θ_1 is such that the net present value of government revenue is zero[15], we can infer that for small values of $[\Theta_0, \Theta_1, \delta_f^* \bar{X}_1/(\bar{X}_0\,\rho) - 1]$ the optimal values of taxes are given by

$$(36)\qquad \begin{aligned} \Theta_0 &\simeq -\,\omega[\log\,\{\delta_f^*\bar{X}_1/(\bar{X}_0\rho)\} - \eta] < 0 \\ \Theta_1 &\simeq (1 - \omega)[\log\{\delta_f^*\bar{X}_1/(\bar{X}_0\rho)\} - \eta] > 0 \end{aligned}$$

where $\omega = \delta^*\bar{X}_1/[\bar{X}_0 + \delta^*\bar{X}_1]$, and we are assuming that the country is a borrower in period zero (or that the endowment bias towards period one exceeds the country risk factor, η). Suppose that we start with no endowment bias $(\delta_f^*\bar{X}_1/\bar{X}_0 = \rho)$ and no country risk $(\eta = 0)$. In such a case, no policies are called for. This is also the case where a consumer with full access to the credit market would not borrow. Suppose now that there is a drop in income in period zero $(\Delta\bar{X}_0 < 0)$, leaving $\bar{X}_1$ intact. In such a case

$$(37)\qquad \begin{aligned} \Delta\Theta_0 &\simeq \frac{\Delta\bar{X}_0}{\bar{X}_0}\,\omega < 0 \\ \Delta\Theta_1 &\simeq -\,\frac{\Delta\bar{X}_0}{\bar{X}_0}\,(1 - \omega) > 0 \end{aligned}$$

Thus, optimal policies call for a net subsidy in period zero and a net tax in period one. Such a policy transfers income from period one to period zero. This is also the case in which a consumer who has access to the credit market borrows in period zero.[16]

Suppose now that the transitory drop in income in period zero comes with a rise in country risk (η). Higher country risk weakens the use of the subsidy cum tax scheme as a means of intertemporal transfer of income. This is also the case in which borrowing by the consumers who have access to the credit market should be taxed. In general, optimal policies allow the consumer who is subject to credit rationing to use the credit market indirectly in order to smooth the path of consumption over time.

It is relevant to note that in a mixed economy, where some consumers are subject to liquidity constraints, whereas others have full access to the domestic credit market, there is a need for taxes on borrowing as well as for time varying consumption cum production taxes and subsidies. In such a case (31) defines the path of consumption cum production taxes, and (29) defines the borrowing tax that is consistent with the path of consumption taxes.[17]

A potential difficulty of our analysis in this section is the lack of additional channels that allow a consumer subject to credit rationing to smooth consumption. These channels include investment in productive capital and the presence of money. It can be shown that the main results remain intact in the presence of these channels. Finally, while our discussion was formulated in terms of a one good model, it can also be varified that (because optimal policies do not affect within-period relative prices) all the results regarding optimal policies hold for a two (or n) goods model.[18]

IV. Concluding Remarks

Rather than repeating the summary from the introduction, we conclude with an outline of possible extensions. Throughout the paper we have evaluated the conditions under which the presence of country risk can introduce a domestic distortion, and we have studied the implied characteristics of the supply of credit and the optimal domestic policies. We considered a simple example in which there is incomplete information regarding the default penalty. The present paper does not allow for the possibility of a direct feedback between the borrower's policies and the evaluation of the country risk. An extension that allows for such a possibility would be useful, bringing up issues related to credibility and reputation.

Footnotes

[1]See for example, Harberger (1976, 1980); Eaton and Gersovitz (1981); Cooper and Sachs (1984), Sachs (1984); Edwards (1984, 1985); Dornbusch (1985).

[2]On the economics of a two-tier exchange rates see, for example, Flood and Marion (1982), Bhandari and Decaluwe (1983), Obstfeld (1984), Adams and Greenwood (1985), Aizenman (1985), Frenkel and Razin (1985) and Von Wijnbergen (1985).

[3]For a related discussion, see Sachs (1984) and Eaton (1985).

[4]Notice that a higher ε implies a higher mean and a higher variance of τ . The main results of our analysis would not be affected if we consider a mean preserving changes in ε .

[5]As will be shown in section 3, this consideration may justify the need to apply a two-tier exchange rate system (i.e. a quote on borrowing combined with an optimal tax).

[6]It also implies that for $B_L < B < \bar{B}$ η is given by $\frac{(1 + r^*)\, \Psi_0 B}{N - (1 + r^*)\, \Psi_0 B}$.

[7]Equation (10) implies that for $\varepsilon = \ln 2$ $d \log B / d \log (1 + r^*) = 0$ at B_L , and that for $\varepsilon < \ln 2$ $d \log B / d \log (1 + r^*) < 0$ at B_L. Thus, $B_L = \bar{B}$ for $\varepsilon \leq \ln 2$. For $\varepsilon > \ln 2$ $\bar{B}$ is obtained by noting that (10) implies that $N / [(1 + \bar{r}^*)\, \Psi_0\, \bar{B}] = 2$. By applying this information to (9) we obtain the solution for $(\bar{r}^*, \bar{B})$.

[8]Equation (24) can be obtained by summing the private and the public sector budget constraints, while remaining aware that each sector faces a different discount rate. For the details of such a calculation (though in a different context) see Aizenman (1985).

[9]For a related study see Jones (1967), who derived the optimal tariff and tax on capital inflows in the presence of market power, and Harberger (1980).

[10]Our analysis has been conducted for the case of an incomplete and <u>symmetric</u> information regarding Ψ . It can be extended to allow for <u>asymmetric</u> information by allowing different density functions $g(\Psi)$ for the lender and the borrower. Let $g_B(\Psi)$, $g_L(\Psi)$ stand for the density function from the borrower and lender perspectives, respectively. In such a case the supply of credit (5) is determined according to g_L (i.e., P in (5) should be replaced by P_L, $P_L = \int_{-\infty}^{Z} g_L(\Psi)d\Psi$) , whereas the expected utility (18) is determined by applying g_B(i.e., g in (18) should be replaced by g_B). It can be shown that the optimal domestic policy is defined by (29), where η is replaced by η_L ($\eta_L = d \log P_L/d \log((1 + r^*)B)$) .

[11]From (29) we infer that $\alpha = \dfrac{(1 + r^*)[\theta_1 - \theta_0 + \eta (1 + \theta_0)]}{(1 - \eta) r^*(1 + \theta_0)}$.

[12]For example, if the supply curve is akl (Figure 1), the 'shadow' supply curve defined by (9) includes a backward bending section ('ln' in Figure 1). The optimal policy has also the consequence of excluding equilibria along the backward bending portion of akln (equilibria that are inferior relative to the one obtained with $B = \bar{B}$, $r^* = \bar{r}^*$ and $r = \bar{r}$) .

[13]For a study on liquidity constraints in a macro context, see Scheinkman and Weiss (1984). For a survey on tests for liquidity constraints see Hayashi (1985).

[14]A revenue nuetral policy that reduces taxes in period zero and raises taxes in period one ($\Delta\theta_0 < 0 < \Delta\theta_1$) can be shown to change welfare by

$$\frac{\Delta V}{V_{X_0}} = [\delta^*(1 - \eta) - \phi] \frac{(\bar{X}_1 + \bar{Y}_1)}{(1 + \theta_1)^2} \Delta\theta_1 .$$ Thus, if

$\delta^*(1 - \eta) = \phi$ the Ricardian equivalence proposition hold: welfare is not affected by a marginal change in the timing of taxes.

[15]Formally, it requires that $X_0 + \delta^* X_1^n = \bar{X}_0 + \delta^* \bar{X}_1$, which, using the consumer budget constraints for periods zero and one implies $\bar{X}_0 \dfrac{\theta_0}{1 + \theta_0} = - \delta^* \bar{X}_1 \dfrac{\theta_1}{1 + \theta_1}$

[16]Notice that if the drop in income is permanent, such that $\bar{X}_1/\bar{X}_0$ is not affected, no policies are called for.

[17]Note that in the presence of heterogeneous consumers subject to credit rationing and the lack of transfer policies conditional on income, optimal policies are not capable of mimicking the intertemporal distribution achieved without credit rationing.

[18]Notice that in the presence of two goods a desired path of $\theta_1 - \theta_0$ can be obtained by imposing tariffs and export subsidies at an equal rate (θ_i in period i, i = 0, 1).

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