On Overborrowing

By Martín Uribe*

A central question in emerging-market macroeconomics is what factors lead countries to accumulate excessive levels of external debt. It is often argued by economic observers and policymakers that emerging markets tend to overborrow when the lending decisions of foreign financial institutions are guided by rough indicators of the emerging country's macroeconomic performance, and not by careful assessment of individual borrowers' abilities to repay. This is because individual agents fail to internalize the effect their own borrowing decisions have on the country's aggregate credit conditions. Overborrowing, it is argued, makes emerging countries prone to balance-of-payments crises, or sudden stops, and calls for government policy aimed at putting sand in the wheels of external finance. The purpose of this paper is to investigate whether the type of lending practices described above indeed lead emerging countries to overborrow.

To this end, I characterize the equilibrium dynamics of a small, open-economy subject to an aggregate borrowing constraint. I have in mind a situation in which foreign lenders lack the ability or the incentives to monitor individual investment projects in the emerging country, and instead base their lending decisions on observation of a few macroeconomic indicators, such as total external debt or output growth. Individual agents do not internalize the credit constraint. I assume that in this economy credit rationing is implemented through a market mechanism. Specifically, when the aggregate debt limit is reached, an interest-rate premium emerges in the domestic economy that ensures individual borrowing decisions are collectively compatible with the aggregate credit constraint. I compare the equilibrium dynamics of this economy to those of an economy in which the borrowing limit is imposed at the level of each individual agent.

The specific question that my investigation aims to address is whether the economy with the aggregate debt limit tends to overborrow relative to the economy with debt limits imposed at the level of each individual agent. I find there is no overborrowing in equilibrium. The reason is that in the economy with the aggregate credit constraint, market incentives, conveyed by the interest rate, induce individual saving decisions that are identical to those caused by the imposition of agent-specific debt limits.

I. An Economy with an Aggregate Borrowing Ceiling

Consider an economy populated by a large number of identical households with preferences defined over consumption of a perishable good, c_t, and labor effort, h_t, and described by the utility function

$$E_0 \sum_{t=0}^{\infty} \theta_t U(c_t, h_t) \tag{1}$$

where U denotes the period utility function, which is assumed to be increasing in the first argument, decreasing in the second argument, strictly concave, and twice continuously differentiable; θ_t/θ_{t-1} denotes the subjective discount factor. In modeling small, open economies, it is typically assumed, as a way to ensure stationary equilibrium dynamics, that the subjective rate of discount is a function of endogenous variables (see, for instance, Stephanie Schmitt-Grohé and Uribe, 2003). Here, I assume that $\theta_0 = 1$ and that $\theta_t/\theta_{t-1} = \beta(C_t, H_t)$, where C_t and H_t denote, respectively, aggregate consumption and hours worked, and β is a function assumed to be decreasing in its first argument and increasing in its second argument. The household takes the evolution of C_t and H_t as given. The choice of

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aggregate variables as arguments of the discount factor simplifies the household's optimality conditions. It will become clear, however, that the central result of this paper is robust to assuming that the discount factor is a function of the individual levels of consumption and effort.

Output, denoted y_t, is produced with a technology that takes labor as the only input. Production is subject to an aggregate stochastic stationary productivity shock denoted by z_t. Formally, $y_t = e^{z_t}F(h_t)$. The production function, F, is assumed to be positive, strictly increasing, and strictly concave.

The only financial asset available to households is a risk-free international bond. Letting a_t denote agent's debt due in period t, his sequential budget constraint is given by

$$\frac{a_{t+1}}{R_t} = a_t + c_t - e^{z_t}F(h_t) \tag{2}$$

where R_t denotes the gross interest rate on assets held between periods t and $t + 1$. Households are assumed to be subject to a no-Ponzi-game constraint of the form $\lim_{j\to\infty} E_t(a_{t+j+1}/\Pi_{s=0}^{j} R_{t+s}) \leq 0$.

The household's problem consists in choosing contingent plans c_t, h_t, and a_{t+1}, so as to maximize (1) subject to (2) and the no-Ponzi-game constraint, given the processes R_t and z_t and the initial condition a_0. The first-order conditions associated with this problem are (2), the no-Ponzi-game constraint holding with equality, and

$$-\frac{U_h(c_t, h_t)}{U_c(c_t, h_t)} = e^{z_t}F'(h_t), \tag{3}$$

$$U_c(c_t, h_t) = \beta(C_t, H_t)R_tE_tU_c(c_{t+1}, h_{t+1}).$$

Foreign lenders impose an aggregate borrowing limit on the domestic economy, which stipulates that the aggregate per capita level of external liabilities assumed by the country in any period $t \geq 0$, which I denote by A_{t+1}, be no greater than a ceiling $\kappa > 0$. That is,

$$A_{t+1} \leq \kappa.$$

Foreign lenders take the evolution of the country's external debt, A_t, as given. They interpret this variable as an indicator of the strength of the country's fundamentals and are willing to lend funds to domestic residents without restrictions, as long as the country's external debt is below the threshold κ.

Individual domestic households also take the evolution of A_t as exogenous. At the same time, because all agents are identical, in equilibrium $A_t = a_t$ for all t. In periods in which the aggregate borrowing ceiling is not binding, foreign investors lend to domestic residents at the world interest rate, which is assumed to be constant and equal to $R^* > 1$. When the aggregate borrowing limit is binding, the domestic interest rate may adjust upward to ensure market clearing in the domestic financial market. In this case, the economy faces a country interest-rate premium equal to $R_t - R^*$. It follows that R_t must satisfy $R_t \geq R^*$ and $(R_t - R^*)(A_{t+1} - \kappa) = 0$.

A. *The Rents from Financial Rationing*

When the domestic interest rate, R_t, is above the world interest rate, R^*, a financial rent is generated. Values of R_t above R^* create pure rents, because in this economy there is no default by assumption. The precise way in which these rents are allocated will, in general, have consequences for aggregate dynamics. Here, I consider two polar cases. In one case, all financial rents accrue to the foreign lenders. In the other case, financial rents accrue entirely to domestic residents.

When financial rents are appropriated by nonresidents, increases in the domestic interest rate entail a resource cost to the domestic economy as a whole. This cost is reflected in an aggregate resource constraint of the form $A_{t+1}/R_t = A_t + C_t - e^{z_t}F(H_t)$. Note that this expression features the domestic interest rate, R_t, instead of the world interest rate, R^*.

Alternatively, rents from credit rationing could accrue entirely to domestic residents. This case arises when, possibly because of competition among foreign lenders, domestic financial institutions borrow in the world financial market at the rate R^*. Thus, the country interest-rate

premium represents a net rent to domestic financial intermediaries. I assume that these rents are distributed in a lump-sum fashion among domestic households, which own the domestic financial institutions in equal shares. In this case, the existence of an interest-rate premium does not introduce a resource cost to the domestic economy. The aggregate resource constraint is therefore given by $A_{t+1}/R^* = A_t + C_t - e^{z_t}F(H_t)$. Note that this expression features the world interest rate, R^*, instead of the domestic interest rate, R_t.

In equilibrium, we have that individual and aggregate variables are identical; thus, $C_t = c_t$, $H_t = h_t$, and $A_t = a_t$. We are ready to provide definitions of competitive equilibria when financial rents accrue to foreign lenders and when financial rents accrue to domestic residents:

DEFINITION 1 (Equilibrium when Rents Accrue Domestically): *A stationary competitive equilibrium, under an aggregate borrowing ceiling when rents from financial rationing accrue to domestic residents, is a set of stationary stochastic processes* $\{c_t, h_t, a_{t+1}, R_t\}_{t=0}^{\infty}$ *satisfying*

(4)
$$U_c(c_t, h_t) = \beta(c_t, h_t)R_tE_tU_c(c_{t+1}, h_{t+1}),$$

(5)
$$-\frac{U_h(c_t, h_t)}{U_c(c_t, h_t)} = e^{z_t}F'(h_t),$$

(6)
$$R_t \geq R^*,$$

(7)
$$a_{t+1} \leq \kappa,$$

(8)
$$(R_t - R^*)(a_{t+1} - \kappa) = 0,$$

(9)
$$\frac{a_{t+1}}{R^*} = a_t + c_t - e^{z_t}F(h_t),$$

given the process $\{z_t\}_{t=0}^{\infty}$ *and the initial condition* a_0.

DEFINITION 2 (Equilibrium when Rents Accrue to Foreigners): *A stationary competitive equilibrium, under an aggregate borrowing ceiling when rents from financial rationing accrue to foreign lenders, is a set of stationary stochastic processes* $\{c_t, h_t, a_{t+1}, R_t\}_{t=0}^{\infty}$ *satisfying conditions* (4)–(8) *and the resource constraint*

(10)
$$\frac{a_{t+1}}{R_t} = a_t + c_t - e^{z_t}F(h_t),$$

given the process $\{z_t\}_{t=0}^{\infty}$ *and the initial condition* a_0.

I postpone the characterization of equilibrium in these economies until I describe equilibrium in an economy with an internalized borrowing limit.

II. An Economy with an Individual Borrowing Ceiling

Suppose now that lenders impose a debt ceiling at the level of each individual household. That is,

(11)
$$a_{t+1} \leq \kappa.$$

Unlike in the economy described in the previous section, in this economy, domestic agents internalize the borrowing constraint. Therefore, they will take this constraint into account in solving their intertemporal optimization problem. Accordingly, the household problem consists in maximizing (1) subject to (2) and (11). The optimality conditions of this problem consist of (2), (3), (11), and

$$U_c(c_t, h_t)\left[\frac{1}{R_t} - \xi_t\right] = \beta(c_t, h_t)E_tU_c(c_{t+1}, h_{t+1}),$$

$$\xi_t \geq 0,$$

$$(a_{t+1} - \kappa)\xi_t = 0$$

where ξ_t denotes the Lagrange multiplier associated with the debt constraint (11) divided by the marginal utility of consumption. When the debt ceiling is binding, ξ_t is strictly positive, and the household faces an effective (shadow) interest rate given by $\tilde{R}_t \equiv R_t/(1 - R_t\xi_t)$, which is greater than the market interest rate R_t. This effective interest rate reflects the fact that, at the market interest rate, the household would like to borrow beyond the limit κ.

Foreign lenders supply funds to domestic residents at the world interest rate. Therefore, R_t equals R^* at all dates and states. The following definition of a competitive equilibrium then applies:

DEFINITION 3 (Equilibrium with an Individual Debt Ceiling): *A stationary competitive equilibrium, under an individual debt ceiling, is a set of stationary stochastic processes* $\{c_t, h_t, a_{t+1}, \xi_t\}_{t=0}^{\infty}$ *satisfying*

$$U_c(c_t, h_t)\left[\frac{1}{R^*} - \xi_t\right] = \beta(c_t, h_t)E_t U_c(c_{t+1}, h_{t+1}), \tag{12}$$

$$-\frac{U_h(c_t, h_t)}{U_c(c_t, h_t)} = e^{z_t}F'(h_t), \tag{13}$$

$$\xi_t \geq 0, \tag{14}$$

$$a_{t+1} \leq \kappa, \tag{15}$$

$$(a_{t+1} - \kappa)\xi_t = 0. \tag{16}$$

$$\frac{a_{t+1}}{R^*} = a_t + c_t - e^{z_t}F(h_t), \tag{17}$$

given the process $\{z_t\}_{t=0}^{\infty}$ *and the initial condition* a_0.

We are ready to compare equilibrium dynamics under aggregate and individual debt limits.

III. An Equivalence Result

I show that the equilibrium processes for debt, consumption, hours, and output in the economy with an individual debt ceiling, and in the economy with an aggregate debt ceiling with rents from financial rationing accruing to domestic households, are identical. To see this, consider the economy with an individual debt constraint. Definition 3 lists the equilibrium conditions corresponding to this economy. Equations (12) and (14), together with the fact that $U_c(c_t, h_t) > 0$, imply that $\xi_t \in [0, 1/R^*)$. Define $R_t = R^*/(1 - R^*\xi_t)$. Clearly, $\xi_t > 0$ if and only if $R_t > R^*$, and $\xi_t = 0$ if and only if $R_t = R^*$. With these results in mind, use the definition of R_t to eliminate ξ_t from the equilibrium conditions (12) through (17). It follows immediately that the resulting expressions are identical to the equilibrium conditions pertaining to the economy with an aggregate debt limit and rents accruing to domestic households, given by equations (4) through (9).

We conclude that in the simple economic environment studied here, the practice by foreign investors of basing their lending decisions on macroeconomic indicators—as opposed to individual solvency indicators—does not induce overborrowing. The individual incentives created by the market (i.e., by R_t) in the economy with the aggregate debt limit are exactly the same as those emerging from an individual debt limit. The following proposition summarizes this result.

PROPOSITION 1 (No Overborrowing): *The equilibrium dynamics of* c_t, h_t, y_t, *and* a_t *are identical in the economy with an individual debt limit and in the economy with an aggregate debt limit, with rents from financial rationing accruing to domestic households.*

This proposition is robust to a number of modifications of the basic model within which it was derived. For instance, it can be shown that the equivalence result continues to hold in the context of an economy with capital accumulation. The result can also be shown to be robust to alternative specifications of the discount factor, in particular, when the discount factor is assumed to depend on the individual levels of consumption and effort, as opposed to aggregate measures of these variables. Enriching the sources of uncertainty to include shocks to endowments, tastes, or the world interest rate would also leave the "no-overborrowing" result unaltered.

When rents from financial rationing are appropriated by foreign lenders, it is no longer possible to compare, analytically, the dynamics of external debt in the economies with the aggregate debt limit and in the economy with the individual debt limit. In the working-paper version of this paper (Uribe, 2006), I resort to

numerical methods to characterize competitive equilibria.[1] I find that the distribution of debt is virtually identical in the economy with rents flowing abroad and in the economy with rents remaining within borders. That is, the no-overborrowing result appears to be robust to allow for financial rents to be appropriated by foreigners. The reason for this result is that the debt limit is rarely reached, regardless of where rents are appropriated. This, in turn, is a consequence of the fact that individual agents engage in precautionary savings as the economy's aggregate debt position gets larger.

IV. Interpreting the No-Overborrowing Result

A significant feature of the economy studied in this paper is that when the borrowing limit is internalized, the shadow price of funds, given by the pseudo interest rate $R^*/(1 - R^*\xi_t)$, is constant (and equal to the world interest rate R^*), except when the debt ceiling is strictly binding. Specifically, the shadow price of capital equals the world interest rate, even as households operate arbitrarily close to the debt ceiling. This feature is present in more general formulations of credit constraints than the constant one I consider in this paper.

I conjecture that this characteristic of the economy is an important factor behind the no-overborrowing result and that overborrowing is more likely to arise when, in the economy in which credit frictions are internalized, the (shadow) opportunity cost of funds increases as the individual household assumes larger debt positions. Examples of environments in which this is the case are not difficult to come by. Consider the small, open economy model with a debt-elastic interest rate studied in Schmitt-Grohé and Uribe (2003). Specifically, let $R_t = R(A_{t+1})$, with $R' > 0$. Here, households do not internalize the dependence of the interest rate on their individual debt positions. Let A^* denote the steady-state value of debt in this economy. Then A^* must satisfy the condition

$$1 = R(A^*)\beta$$

where β is a constant subjective discount factor. Assume now that the debt-elastic interest-rate schedule is imposed at the level of each individual household, so that $R_t = R(a_{t+1})$. Let A^{**} denote the steady-state level of external debt in this economy. It can be shown that A^{**} is determined by the condition

$$1 - \frac{A^{**}R'(A^{**})}{R(A^{**})} = R(A^{**})\beta.$$

The two steady-state conditions above imply that

$$A^* > A^{**}.$$

That is, the economy with the financial externality generates overborrowing.

[1] In Uribe (2006), I expand on the calibration, functional forms, and solution method used in the numerical computations. Matlab code to compute the competitive equilibrium of the economies studied in this paper are available at www.econ.duke.edu/~uribe.

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