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Donor herding and domestic debt crisis

Yohane Khamfula[a,*], Montfort Mlachila[b] and Ephraim Chirwa[c]
[a]*Department of Economics, University of Stellenbosch, South Africa*
[b]*Western Hemisphere Department IMF Headquarters, Washington, DC, USA*
[c]*Department of Economics, Chancellor College, University of Malawi, Malawi*

This article presents a new model based on the loan-pushing model by Basu (1991) to show how a domestic debt crisis can occur in a low-income country following donor herding. The model focuses on the rational herding behaviour of donors due to payoff and information externalities. Although there are many theoretical models on herding behaviour, these models have not formally considered the relationship between donor herding and domestic debt crisis in a low-income country. This article is an attempt to fill this gap. The article shows that due to donor herding behaviour a domestic debt crisis can occur once the actual debt level is above the desirable one.

I. Introduction

In this article, we assume that aid donors follow herding behaviour that determines aid flows in a low-income country (LIC). We modify a loan-pushing model by Basu (1991) to introduce the donor herding behaviour that may trigger domestic debt crisis in a LIC. According to Devenow and Welch (1996), rational herding behaviour is usually modeled for three reasons: payoff externalities, principal-agent problems, and information externalities. Our model focuses on rational herding behaviour of donors due to payoff and information externalities. Although there are many theoretical models on herding behaviour, these models have not formally considered the relationship between donor herding and domestic debt crisis in an LIC. This article is an attempt to fill this gap.

Vives (1993) defines 'herding' as behaviour where one person (or agent) observes the action(s) of their predecessor(s), updates their prior belief, and then has more incentive to imitate their predecessor(s) knowing that their choice may *ex post* not be optimal. Thus, agents often infer information out of the actions of other agents. The tendency to base decisions largely on the observed decisions of other agents has been modeled as information externalities. Banerjee (1992) and Bikhchandani *et al.* (1992) (henceforth BHW) introduced the first models that emphasized the inefficiencies of these information externalities in a context of social learning. Each one of these models considers a population of agents endowed with a private, costless and imperfect signal concerning the desirability of a course of action. Chamley and Gale (1994) consider a setup similar to the BHW models, except that all players have the possibility to wait, in order to observe how many players invest in the current period and to make their investment decision in the next period based on superior information. Their analysis shows how bad outcomes and inefficient waiting may occur in equilibrium.

The rest of the article proceeds as follows. Section II presents our model. In Section III, we conclude by offering suggestions for empirical analysis.

*Corresponding author. E-mail: yohane@sun.ac.za

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II. The Model

In our modified loan-pushing model, aid donors base their strategies on what they see other aid donors doing, and they, themselves, are also searching for extra information. As a result of searching for this extra information, there are costs ensuing to donors. The loan-pushing theory is further based on the assumption that aid donors or lenders are supplying more credit to the borrowing LIC than the latter would voluntarily take at the prevailing interest rate.[1] In practice, the assumption that countries are persuaded to take more loans than they are willing to take might not be realistic, as loans are typically given with conditionality, which may be (politically) costly to the borrower. In certain cases, political economy considerations can be an important factor in contracting loans. For instance, when the number of (new) loan-financed projects enters positively in the voting function, in the short term politicians could be inclined to borrow beyond what could be justified by economic return. This aspect is not explicitly modeled here. We also exclude cases of donors acting purely for humanitarian reasons, for example, due to a natural disaster.

Basic model details

In our model, the aid-recipient country announces (L_t, i_t), where L_t is the amount of loan that the LIC wants to borrow, and i_t the interest rate it is willing to pay in a given period, t. Thus, in the model, the borrowing LIC chooses and announces (L_t, i_t) so as to maximize utility. Assume further that each lender supplies either one unit of credit or nothing. Let E_t^S be the expected excess supply of credit, and r_j the lowest rate at which the lender j is willing to lend to the borrower. It is assumed that r_j is inversely related to expected excess supply, E_t^S:

$$r_j = r_j(E_t^s). \tag{1}$$

We assume that the total supply of loans in period t, S_t, to the LIC is determined as:

$$S_t = S_t(E_t^S, i_t) \tag{2}$$

where $\partial S_t/\partial E_t^S \geq 0$ and $\partial S_t/\partial i_t \geq 0$. Donors view an excess supply of loans as a positive sign. Thus, given the *S-function* in Equation 2, aid donors regard the current-period excess supply of loans, E_t^S, as the sign of the LIC's creditworthiness. The lenders (aid donors) then supply the amount of loans or credit on rational expectations, where e is the expectations superscript relative to the information set held in period $t-1$:

$$S_t = S_t(Y_t^e - L_t, i_t) \tag{3}$$

where Y_t^e is the expected supply of funds in the current period; L_t the demand for credit in the current period; and i_t the interest rate the aid recipient or borrower is willing to pay in period t. Aid donors will end up supplying Y units of credit only if this amount satisfies Equation 3.

The lender's expected return, ρ_t^e, in period t is given as:

$$\rho_t^e = (i_t - \pi_t\theta - \gamma_t\lambda)^e \tag{4}$$

S is now a function of the expected supply of funds, Y_t^e, and the lender's expected return, $(i_t - \pi_t\theta - \gamma_t\lambda)^e$. π_t is the default parameter for the borrowing LIC and it lies between 0 and 1. Judging from past performance of a LIC in terms of loan repayment, the donor community is assumed to hold some prior knowledge of the lender's propensity to default. The closer this parameter is to 0 for a given value of θ, the higher will be the lender's expected return. θ is a given constant. Thus, $\pi_t\theta$ is the value of the default costs of the debt to the lender or donor.

The parameter γ_t in the lender's expected return, $(i_t - \pi_t\theta - \gamma_t\lambda)^e$, represents the cost of acquisition of information to the lender and it also lies between 0 and 1. As mentioned above, apart from observing what their peers are doing, donors also seek information about the LIC on their own. There is, however, a cost attached to acquiring this extra information. It should be noted that a lower value of γ_t will imply a higher expected return to the lender. The symbol λ stands for some given constant.

We rewrite the *S-function*, which assumes rational expectations, as follows:

$$S_t = S_t(Y_t^e - L_t, (i_t - \pi_t\theta - \gamma_t\lambda)^e) \tag{5}$$

In the loan-pushing model, the supply of loans in period t, S_t, depends positively on expected supply in period t, Y_t^e, and lender's expected return in period t, $\rho_t^e = (i_t - \pi_t\theta - \gamma_t\lambda)^e$. The supply of new loans can be expressed as follows:

$$S_{t+1} = \begin{cases} 0, \text{ if } (i_{t+1} - \pi_{t+1}\theta - \gamma_{t+1}\lambda)^e < \rho^* \text{ or } Y_{t+1}^e < \overline{Y} \\ \begin{cases} S_{t+1}(Y_{t+1}^e - L_{t+1}, (i_{t+1} - \pi_{t+1}\theta - \gamma_{t+1}\lambda)^e) \\ \text{if } (i_{t+1} - \pi_{t+1}\theta - \gamma_{t+1}\lambda)^e \geq \rho^* \\ \text{and } Y_{t+1}^e \geq \overline{Y} \end{cases} \end{cases} \tag{6}$$

In Equation 6, $\overline{Y}$ is the threshold level of the supply of funds and ρ^* is the threshold level of the

[1] Basu (1991) observes that the interest rate is not the only factor involved; debt maturity and default provisions are also important.

lender's return. If the expected supply in period t, Y_t^e, and the lender's expected return in period t, $(i_t - \pi_t\theta - \gamma_t\lambda)^e$, exceed their threshold levels, $\overline{Y}$ and ρ^* respectively, the LIC receives foreign loans or aid. Otherwise, there is no supply of new loans. This means that the supply function becomes discontinuous at the threshold levels. However, the model presents an extreme case of herding behaviour, since a small decrease in the lender's return will cause a drop in the supply of loans to zero.[2] The strength of the model is that the discontinuity and the reversal of aid flows are explained endogenously, even though the entire primitive behavioural functions – Equations (1) and (2) – in the model are continuous.

Generating a domestic debt crisis

We next show how a domestic debt crisis occurs in the event of n-successive-period simultaneous withdrawals of aid by aid-donors from the borrowing LIC. Suppose that, as a result of either bad governance and corruption or poor macroeconomic management, in period t, aid donors announce their intention to withdraw financial assistance to the LIC with effect from period $t+1$ until favourable conditions prevail in the country. If this situation leads the government to borrow from domestic creditors (other than adjusting its expenditures, for example, in the expectation of a reversal of donors' decision), we can envisage a rise in real interest rates in every period after $t+1$.

We can formalize this scenario as follows. Consider a sequence of T-zero aid flows to the LIC, where T is the number of periods for which the LIC does not have aid inflows following donor herding. Thus, from period $t+1$ up to period T, there is no supply of new loans, namely S_{t+1}, $S_{t+2}, \ldots, S_{t+T}$. From Equation 6 above, we can see that starting from period $t+1$ the condition that $(i_t - \pi_t\theta - \gamma_t\lambda)^e < \rho^*$ or $Y_t^e < \overline{Y}$ must hold to satisfy the outcome. As a result of ensuing high real interest rates on the domestic financial market, the government will start to default on domestic debt as long as accumulated debt in each period is above some threshold level. In each period, we have three likely outcomes:

$$\psi_{t+k} - \varpi^*_{t+k} = \begin{cases} 0, \text{ if } \psi_{t+k} \text{ equals } \varpi^*_{t+k} \\ \text{Negative value, if } \psi_{t+k} \text{ is below } \varpi^*_{t+k} \\ \text{Positive value, if } \psi_{t+k} \text{ is above } \varpi^*_{t+k} \end{cases} \quad (7)$$

where ψ_{t+k} is the actual domestic debt accumulated in period $t+k$ $(k=1,2,\ldots,T)$ and ϖ^*_{t+k} is the level of accumulated domestic debt that the government is able to repay in every period. It is assumed that the actual domestic debt accumulated (ψ_{t+k}) is determined as follows:

$$\psi_{t+k} = f(ri^d_{t+k}, (DS_{t+k}\, x\, ri^d_{t+k})^2) \quad (8)$$

where ri^d_{t+k} is the real interest rate prevailing on the domestic financial market; DS_{t+k} is the dummy variable which takes the value of 1 if there is no supply of foreign aid in period $t+k$ and 0 otherwise; and $(DS_{t+k}\, x\, ri^d_{t+k})^2$ is the square of the interaction variable between DS_{t+k} and ri^d_{t+k}. In Equation 7, the actual domestic debt accumulated in period $t+k$, ψ_{t+k}, is a strictly increasing function of the square of the interaction variable, $(DS_{t+k}\, x\, ri^d_{t+k})^2$; that is, $\partial\psi_{t+k}/\partial(DS_{t+k} x ri^d_{t+k}) > 0$, given that $DS_{t+k}=1$. On the other hand, if $DS_{t+k}=0$, ψ_{t+k} is a decreasing function of ri^d_{t+k}; that is, $\partial\psi_{t+k}/\partial ri^d_{t+k} \leq 0$.

From Equation 7, we can see that as long as ψ_{t+k} is equal to or less than ϖ^*_{t+k}, a debt crisis does not occur in the LIC. A debt crisis occurs once ψ_{t+k} is greater than ϖ^*_{t+k}. The first two outcomes will obtain if the government of the LIC responds to donor herding by simultaneously reducing its expenditures and borrowing a well-calculated sum of loans from the home financial market. If no reduction to fiscal expenditures is made, then the third outcome (domestic debt crisis) is likely to be faced by the LIC.

III. Conclusion

Based on the analysis presented earlier, the main empirical research question that arises, therefore, is whether the changes in domestic debt stocks are linked to sudden shifts in external aid inflows, exacerbated by donor herding. Subsequent empirical work will need to establish whether there has been donor herding; that is, whether changes in the flows of assistance by one donor have been heavily influenced by one or more other donors. Concretely, this could be done, for example, by determining whether the growth rate of domestic debt beyond a certain threshold is explained by a decline in donor aid below a certain threshold, after controlling for a number of macroeconomic environment variables. Empirical work would also need to determine why, when faced with imminent or actual cuts in

[2] This is a corner solution. In practice, there may be a minimum level of donor inflows, for example, in the form of humanitarian aid. However, the results obtained in this case would not be qualitatively different from what follows in the rest of the article.

donor assistance, the government did not cut expenditure or raise revenues.[3] Finally, the empirical analysis could also usefully assess the consequences of the behaviour of the government for domestic economic outcomes.

A major challenge of the empirical work will be to gather the data on individual donor financing commitments and disbursements with sufficient frequency (monthly or quarterly), and over a sufficiently long period. Finding adequate domestic debt data on stocks and flows by type and holder, while easier, is not a trivial exercise as most LICs do not have good domestic debt data beyond banking system credit, and on treasury bills and bonds.

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[3] A possible reason could be that the LIC government believes that donors will be faced with the 'Good Samaritan's' dilemma, and not walk away for a prolonged period.