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Discussion

Comment on: "Bond finance, bank credit, and aggregate fluctuations in an open economy" by Roberto Chang, Andres Fernández, Adam Gulan

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1. Roadmap for discussion

This paper is motivated by the increase in foreign financing observed in emerging markets in the last decade, with a particular focus on the fact that a disproportionate share of the increase takes the form of bond financing. The authors present a quantitative dynamic equilibrium model that matches this trend and then explores the implications of a decline in the world risk-free interest rate.

In my discussion, I will present a stripped down static model to give some intuition regarding why bonds rather than bank loans are the elastic margin of credit expansion. I will make comments about important assumptions (both mine and theirs) as I proceed. I will conclude with some general thoughts on the project as a whole.

2. A simple model

Consider an entrepreneur who must manage a project of size I. At the start of the period, the manager has $A \leq I$ to invest, and must raise the additional funds either in the bond market or the bank-loan market (or both). At the end of the period, the project pays out $R > 1$ if successful, and zero otherwise. The manager as well as lenders have a discount factor of one between the start and the end of the period. Everyone also has linear utility over end-of-period payoffs in the single good.

The manager must raise $I - A$ from outside lenders. However, there is a financial friction due to moral hazard. If the manager exerts effort (or invests "wisely"), which is private information, the probability of success is p_H. Otherwise, the probability is $p_L < p_H$. However, by shirking or diverting investment, the manager captures a private utility gain. The gain is BI if the manager relies exclusively on the bond market. Let R^f denote the payment to the manager if the project is successful. In the case of bonds-only financing, the manager will invest wisely as long as $p_H R^f \geq p_L R^f + BI$. Letting $\Delta \equiv p_H - p_L$, we can write the incentive constraint as:

$$R^f \geq \frac{BI}{\Delta}. \tag{1}$$

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For bond holders to break even in expectation, they require an expected return of at least $I-A$. Given the payment of R^f to the manager, the investor's break even condition is:

$$p_H\left(RI-R^f\right)\geq I-A. \tag{2}$$

The maximal payment to lenders occurs when (1) binds with equality, which places a floor on the payments to the manager. Using a binding (1) to substitute out R^f in Eq. (2), we have:

$$p_H\left(R-\frac{B}{\Delta}\right)I\geq I-A.$$

Re-arranging gives a bound on leverage:

$$\frac{A}{I}\geq 1-p_H\left(R-\frac{B}{\Delta}\right). \tag{3}$$

If I were a choice variable, then the manager could simply scale the project according to their initial funds A. However, if I is fixed, then a manager may not have enough wealth to get the project off the ground by issuing bonds. The minimum initial wealth for bonds-only financing is hence:

$$\overline{A}\equiv\left[1-p_H\left(R-\frac{B}{\Delta}\right)\right]I. \tag{4}$$

The alternative to issuing bonds is to raise funds from a bank. A bank is a more effective monitor of the manager than bonds holders. Specifically, a bank can reduce the manager's private benefits from shirking to $bI<BI$. This implies an alternative incentive constraint on R^f:

$$R^f\geq\frac{bI}{\Delta}. \tag{5}$$

While this relaxes the manager's leverage constraint, it requires monitoring from the bank. The cost of monitoring a project of size I is cI. For this to be worthwhile for the bank, they need a large enough payment conditional on the project's success. Letting R^m denote the bank's payout given success, the bank's IC constraint is:

$$p_H R^m\geq p_L R^m+cI,$$

or

$$R^m\geq\frac{cI}{\Delta}. \tag{6}$$

Suppose a manager borrows I^m from the bank and $I-I^m-A$ from bondholders. Let β denote the banker's expected rate of return:

$$\beta\equiv\frac{p_H R^m}{I^m}. \tag{7}$$

We can use this to write (6) in terms of β and I^m rather than R^m:

$$I^m\geq\frac{p_H cI}{\beta\Delta}. \tag{8}$$

If β were one, then the cost of bank lending is the same as bond lending, but with the added benefit of reducing moral hazard. In that case, the manager would raise enough from the bank to ensure adequate monitoring at an expected return of one (which may involve investing surpluses in some other security). However, suppose there are barriers to entry to banking, so that in equilibrium $\beta>1$. In this case, bank lending is relatively expensive, and managers will minimize their use of it. In particular, the minimum scale is when (8) holds with equality. The residual, if any, is financed by issuing bonds. The bondholders break even condition is then:

$$p_H\left(RI-R^f-R^m\right)\geq I-I_m-A. \tag{9}$$

Using (with equalities) (6) to substitute for R^m and (6) to substitute out I_m, we have a new leverage constraint:

$$\frac{A}{I}\geq 1-p_H\left[R-\frac{b}{\Delta}-\left(1-\frac{1}{\beta}\right)\frac{c}{\Delta}\right]. \tag{10}$$

Comparing (10) with (3), we see that bank financing allows for a higher degree of leverage as long as $b+c(1-1/\beta)<B$. The equilibrium β will ensure this holds, as otherwise there is no demand for bank financing, driving β to one. For a given scale I, the minimal initial wealth is now:

$$\underline{A}\equiv I\left(1-p_H\left[R-\frac{b}{\Delta}-\left(1-\frac{1}{\beta}\right)\frac{c}{\Delta}\right]\right). \tag{11}$$

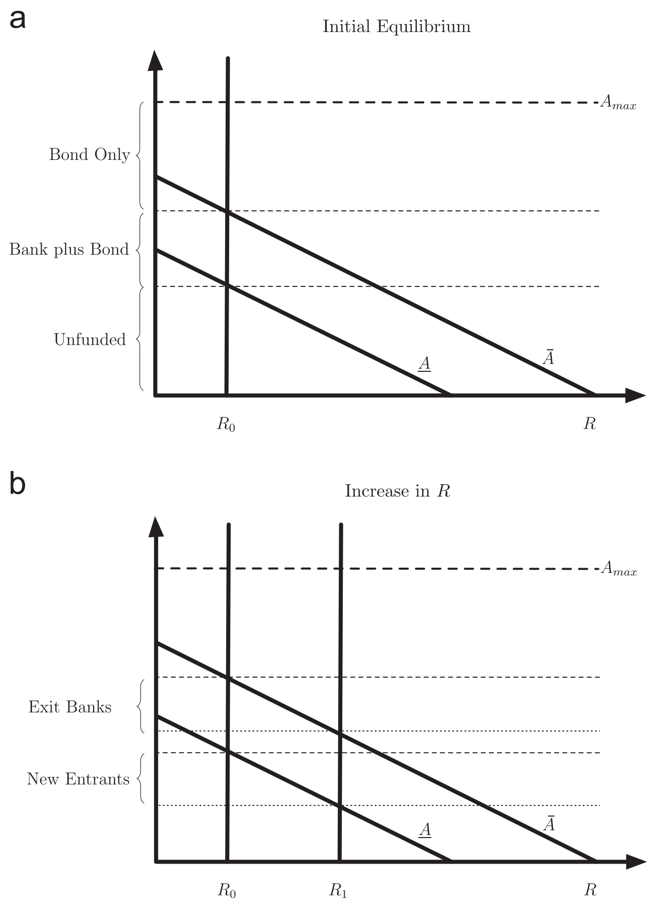

Fig. 1. Lending equilibrium.

Note that $\underline{A}$ is increasing in β. That is, as bank lending becomes more expensive, the need for initial equity increases to satisfy the manager's incentive constraint.

To close the model, we need to pin down β. One option is free entry that ensures $\beta=\overline{\beta}$. An alternative is to assume a fixed amount of bank funds that can be lent out to a continuum of firms, K^m. Letting $G(A)$ denote the distribution of managerial equity across firms in the economy, and holding I fixed across firms, market clearing in bank loans requires:

$$K^m=\int_{A}^{\overline{A}} I^m dG(A)=\frac{p_H cI}{\beta\Delta}\left[G(\overline{A})-G(A)\right]. \tag{12}$$

A convenient simplification is if G is uniform on $[A_{min}, A_{max}]$. In this case, the term in square brackets becomes:

$$G(\overline{A})-G(\_A\_)=\overline{A}-A=\frac{I}{\Delta}\left[B-b-\left(1-\frac{1}{\beta}\right)c\right],$$

which is independent of R.

Fig. 1 panel(a) denotes the equilibrium outcome in $A\times R$ space. The two downward sloping lines represent $\overline{A}$ and $\underline{A}$ as functions of R, which are given by (4) and (11), respectively. Given the uniform distribution, β is independent of R, and thus $\underline{A}$ (which depends on β) is parallel to the $\overline{A}$ line (which does not depend on β). The vertical line represents the initial return of the project, R_0. For those managers with $A<\underline{A}$, they cannot get financing for the project. For those with $A\in[\underline{A},\overline{A})$, they require some bank financing. For those with enough initial funds, $A\geq\overline{A}$, they rely exclusively on bonds. Given the uniform distribution, the measure of firms in each category is simply the distance along the vertical axis.

Now consider an increase in the relative return of the project R from R_0 to R_1. This can be interpreted as a decline in the world risk-free rate. The vertical line shifts to the right in panel (b), and $\overline{A}$ and $\underline{A}$ decrease accordingly. The decline in $\underline{A}$ implies more firms can get sufficient financing for the project ("new entrants"). The decline in $\overline{A}$ implies that more firms can switch from bank loans to bonds-only financing ("exit banks"). In the scenario depicted, the entry equals the measure of firms exiting bank lending. Thus, the margin of adjustment in terms of financing is exclusively bond financing.

This derivation obviously relies on the distributional assumptions. However, the intuition is more general than the specialness of the uniform case suggests. In particular, the finite stock of bank lending K^m implies that if entry into bank lending exceeded exit, then β would rise to insure market clearing. This would generate an increase in $\underline{A}$, mitigating the inflow of new firms. This is clear from the market clearing condition (12). The measure of firms between $\overline{A}$ and $\underline{A}$ is inversely related to β. As the measure of bank customers increases, β increases, and, from (11), the threshold for entry increases. There is therefore an equilibrium force at work that restricts the expansion of bank lending that is not present for bonds (which always have an expected yield of one in equilibrium). It is the fact that bonds are the preferred source of funding at the margin (that is, $\beta > 1$), combined with the finite amount of bank capital, that makes bonds the more elastic margin for increased leverage. While this is not sufficient to say that some other distributional assumption cannot yield a different relative shift in bonds versus bank financing, it does provide a simple intuition for the fact that bonds are the more elastic margin in the authors' computational model.

3. General comments

In the paper, a holding company chooses a one-size-fits all scale for its subsidiaries, but capital is not allocated uniformly. This raises the question of why subsidiaries do not choose scale optimally given their available funds. If they did so, all subsidiary "firms" can choose I to match their idiosyncratic A. It is optimal for every firm to produce (assuming $A > 0$), and everyone uses a combination of bank debt and bond financing. In particular, I will be determined by (10) holding with equality. Let

$$\kappa \equiv 1 - p_H\left[R - \frac{b}{\Delta} - \left(1 - \frac{1}{\beta}\right)\frac{c}{\Delta}\right],$$

then $I = A/\kappa$. From (8), we have

$$\begin{aligned} I^m(A) &= \frac{p_H c I}{\beta\Delta} \\ &= \frac{p_H c}{\kappa\beta\Delta}A. \end{aligned}$$

Substituting into the bank loan market clearing condition and integrating over the entire support of A, we see that β is pinned down by parameters, but independent of R. Thus I^m/I is independent of R. An increase in R generates more leverage in the economy as κ falls. I increases, and I^m increases proportionally. Bond financing as a ratio to scale is $(I - I^m - A)/I$. As leverage increases, the ratio of bond financing to I (as well as to bank lending), therefore increases. Thus, when project size is chosen optimally, the ratio of bond financing to bank loans increases in the net return R. Again, this follows from the fact that bank capital is a scarce resource.

The model establishes the relative roles of passive financing versus bank monitoring. One issue is that while the amount of monitoring is pinned down in equilibrium, there is no prediction regarding passive funding intermediated through banks. That is, once a firm is monitored, it can raise funds at the margin at the equilibrium return of one. This could be bond financing, as in the model, or deposits offering the same return, which are then intermediated through banks. Thus the scale of bank lending as measured in the data is not clear.

The paper does a nice job making the case for why the margin of expansion is disproportionately bond financing. From a normative perspective, this raises some interesting questions. In practice, bank loans are often implicitly guaranteed. This distortion makes bank monitoring harder to enforce. A higher return (or lower risk-free interest rate) opens the door to bond financing, making the implicit guarantee less of a concern. Therefore there may be some nice efficiency gains from a decline in the world interest rate.

Another interesting question concerns the fact that sovereign lending is also shifting towards bond financing since the early 1990s. The authors' model does not straightforwardly extend to sovereign bonds. However, the similarity in the trends seems to suggest a common explanation may be warranted.

Finally, bank lending in the model allows for greater leverage, letting less well-capitalized firms reach the necessary scale. This raises the question of whether the important implication is the overall level of leverage (say, the level of B), or does the fact that there are two sources of lending play an independent role. The initial draft was silent on this issue, but the final version does a nice job of discussing that having both sources is important for macroeconomic outcomes.