

## Why Firms React Differently to Credit Shock: Financial Constraint and Margins of FDI Revisited



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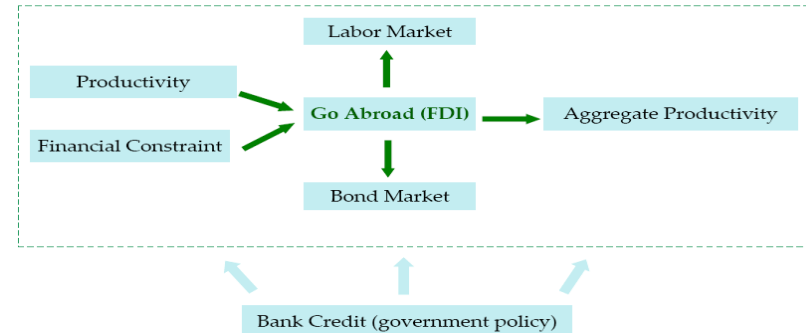
### Research Questions

1. Why do firms behave differently facing credit crisis?
2. How do financial factors, i.e., bond return rate and bank credit access, affect margins of FDI?
3. What is the link of financial development and aggregate productivity gains?

### Motivation

1. Facing the tightness of bank credit during the recent financial crisis, most firms cut their sales while a non-negligible fraction of firms kept their sales unchanged or even expanded.
2. Bank credit is not the only external finance.
3. Firms adjust financing strategy and reallocate available funds among different projects facing credit shocks.

### An overview of the model



### Key Literature

1. Aghion, P., Angeletos, G.-M., Banerjee, A. and K. Manova (2005). "Volatility and Growth: Credit Constraints and Productivity-Enhancing Investment." Harvard University mimeo
2. Manova, K. (2007). "Credit Constraints, Heterogeneous Firms, and International Trade " Stanford University Working Paper
3. Melitz, Marc (2003). "The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity," *Econometrica* 71(6), pp. 1695-1725

## Key Ingredients of the Model

- Firms are heterogeneous in productivity  $\varphi$ .
- Firms have three investment options: (1) purchasing corporate bonds; (2) producing and selling in domestic market; (3) engaging in FDI.
- For the existence of fixed cost  $f$  in domestic production and extra fixed cost  $C_F$  in FDI, firms are partitioned by productivity. Firms with  $\varphi < \varphi_{iD}^*$  give up production and invest all their internal funds to purchase bonds. Firms with  $\varphi_{iD}^* < \varphi < \varphi_{iF}^*$  produce domestically. Firms with  $\varphi > \varphi_{iF}^*$  engage in domestic production as well as FDI.
- The additional fixed cost of FDI is uncertain ex ante. FDI is successful if and only if the additional fixed cost turned out to be fully covered. Firms may set aside a reserve fund to cover the extra cost.

## Firms' optimization problem

maximize the total profit of investment portfolio

$$\max_{p_{iD}, p_{iF}, A_i, B_i} E[\pi_i] = E\{p_{iD}q_{iD} - w_D l_{iD} + (p_{iF}q_{iF} - w_F l_{iF}) \Pr(A_i + \mu \tau f > C_F) + rB_i\}$$

$$s.t. \quad w_D l_{iD} + w_F (l_{iF} - C_F) + A_i + B_i \leq N_i - f_e$$

## Notes:

$p$  represents price,  $q$  output,  $w$  wage,  $l$  labor input,  $C_F$  extra fixed cost of FDI with Expectation  $C$ ,  $r$  bond rate,  $B$  bond holding ( $B < 0$  for bond issuing),  $N$  initial wealth,  $f_e$  entry cost for the industry. A fraction  $\tau$  of overhead fixed cost  $f$  as collateral to obtain bank credit.  $\mu$  is credit multiplier against collateral.  $A$  is the reserve fund the firm keeps aside to cover  $C_F$ .  $A$  is either from initial fund or issuing bonds. The subscript  $D$  denotes variables for domestic production and  $F$  for foreign production.  $i$  is firm index.  $\Pr$  denotes probability.  $P, Q$  are aggregators.  $\varepsilon$  is the elasticity of substitution.



- There exists a perfect bond market. All firms have access to the bond market where more productive firms issue corporate bonds to fill the gap of working capital over internal funds while less productive firms hold bonds to get the safe return.
- For those firms going abroad, they could get an extra supporting bank credit with zero interest rate to cover the additional cost of production in foreign country.

## Cutoff Productivities for Domestic Production and FDI

$$\varphi_{iD}^* = \left\{ \frac{f(\varepsilon-1)}{Q} \left[ \frac{\varepsilon w_D (1+r)}{(\varepsilon-1)P} \right]^\varepsilon \right\}^{\frac{1}{\varepsilon-1}}$$

$$\varphi_{iF}^* = \left\{ \frac{f(\varepsilon-1)}{Q} \left[ \frac{\varepsilon w_F (1+r/\Pr)}{(\varepsilon-1)P} \right]^\varepsilon \left( 1 + \frac{\Pr C + rA / w_F}{(\Pr+r)f} \right) \right\}^{\frac{1}{\varepsilon-1}}$$

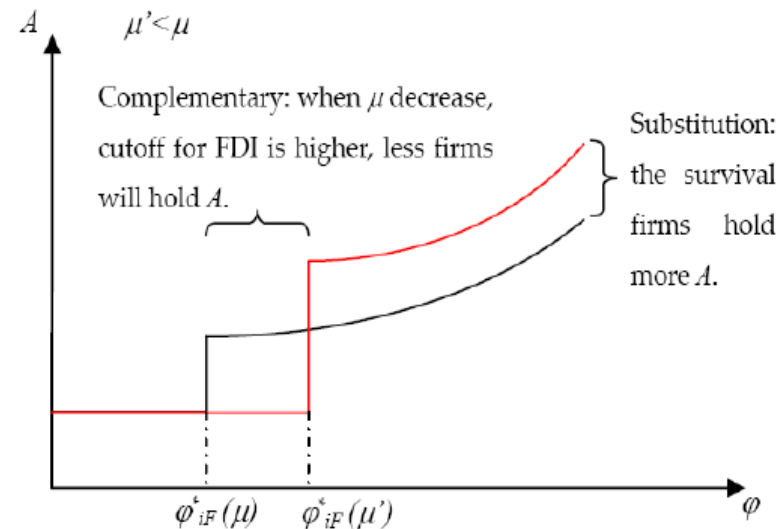
## New Features of the Model

- introducing bond market as alternative external finance besides bank credit. Bond finance and bank finance are complementary and substitute.
- modeling domestic investment and foreign investment together. Reallocation of available funds is allowed.



## Main Findings: Substitution Effect and Complementary Effect of Bank Finance and Bond Finance

Facing a bank credit supply shock (negative shock, e.g.,  $\mu$  decreases to  $\mu'$ ), FDI firms of different productivities react in different ways. Some very productive firms maintain FDI, and they will issue more bonds at a higher bond rate to compensate the decreased bank credit (substitution effect of bank finance and bond finance). Meanwhile, due to less availability of bank credit, less productive firms will be forced to exit the foreign market. Comparing to the firms who maintain FDI, these firms have no incentive to issue bonds to finance working capital because it is too expensive to afford. In this case, less bank credit induces less bond issuing. We call this the complementary effect of bank finance and bond finance.



## Main Findings



- **Financial Constraint and Margins of FDI:** on one hand, less credit availability leads to higher cutoff productivity for FDI and lowers expected profit, and consequently firms are less likely to do FDI (extensive margin); on the other hand, less credit access induces firms' reallocation of available funds, including internal funds and funds from issuing bond. Therefore whether firms expand or contract foreign affiliates output depends on their productivities (intensive margin). More productive firms are able to keep foreign production unaffected or even expanded whereas less productive ones shrink or even exit.
- **Financial Constraint and Firms' Partitions:** under looser financial constraint, either lower bond rate or larger bank credit multiplier, both cutoffs are lower while the cutoff for FDI decreases more. This implies that, on one hand, FDI activity is more sensitive to financial constraint, on the other hand, relaxing financial constraint could help incumbent domestic firms grow into multinationals.
- **Selection Effect through Bond Market and Aggregate Industry Productivity:** Firms' foreign expansions cause selection effect across heterogeneous firms through the adjustment in labor market as well as bond market, and bring aggregate productivity gains. Whether worse bank credit conditions intensify or weaken the productivity gains is ambiguous. It relies on the overall outcome of complementary effect and substitution effect between bank credit and bond finance. (More productive firms issue more bonds which bids up the bond rate while less productive firms exit and pushes the bond rate down. The two effects fight each other in the bond market).

## Prospects

- we continue with our work by changing the perfect bond market into firm specific bond. Firms with different productivity issue bonds at different rate. We investigate the relationships between firms' financial structure and their FDI behaviours. The bridges include the productivity, the risk of FDI, bank efficiency and liquidation cost when there is default.