The role of Securities with Discontinuous Payoff Function in the Credit Market

Aris Gkaintes & Kostas Koufopoulos
University of Athens & University of Piraeus

Introduction

- Consider firm financing under ex-ante asymmetric information (hidden types or adverse selection).
- There are two groups of agents: entrepreneurs and financiers.
- Each entrepreneur has a positive net present value project that requires some investment, but not initial wealth.
- The entrepreneurs have to raise the required amount of funds from the financiers (market) by issuing some securities.
- Each project's return depends both on the amount of funds invested and its inherent quality (type).
- The project type is private information of the entrepreneur.

Literature Review

- Most existing papers on financing under ex-ante asymmetric information exogenously impose that the security issued for raising the required amount of funds is debt
- For example, Martin (2009) assumes that debt is issued and shows that, depending on parameter values, the equilibrium may be either pooling or separating and regardless of the equilibrium configuration the level of aggregate investment is sub-optimal.
- Another strand of the literature uses collateral as a screening device and shows that the first-best level of investment can be implemented only if the collateral is limitless and can be used without any cost. Otherwise, there is underinvestment. (For example see Bester, 1985, 1987).
- *In our paper we show that under plausible assumptions and the use of securities with discontinuous payoff function (barrier options) the social efficient investment can be restored.*

The Model

- There are two dates $t \in \{0, 1\}$
- One homogeneous good which can be used either for consumption or investment purposes
- Firms do not have any assets in place which could be used as collateral but they are allowed to issue any type of security they wish (including non-monotonic securities)
- At time 0 entrepreneur invests I_i for his project (with $i = G, B$), and he is the only one that knows the type of the project (**Adverse Selection**).
- There are two states of nature: Success, Failure. If successful (unsuccessful) an entrepreneur of type i who invests I_i obtains a gross return of $X_i = \alpha_i f(I)$ ($zero$), where $\alpha_G < \alpha_B$ and $p_G \alpha_G > p_B \alpha_B$.

Pure Adverse Selection

- Let's consider now what happens when the financier cannot distinguish the type of the entrepreneur.
- In this case the bad entrepreneur has always the incentive to mimic the good one and invest more while paying less interest rate.
- As a result, separating equilibrium is impossible and we consider only the pooling equilibrium.
- Compare to the first best the good type issues mispriced securities where he invests less and pay more interest, while the bad type invests more and pays less interest.
- This means that the good type subsidizes the bad type.
- However, since there are no assets in place he will always issue mispriced debt and invest.

Introduction of Barrier Options

Suppose that entrepreneurs can also issue barrier options. The exercise of the barrier option conditions to the value of the underlying asset. If it is exercised, its holder receives a pre-specified fraction of the firm's (project's) shares η

A barrier option which can be exercised only if the gross return of the underlying project is higher than X_G and its strike price is zero.

Proposition

- There is a pooling equilibrium where both G-type and B-type issue debt with interest factor $R_G = \frac{1}{p_G}$ and a barrier option with strike price zero which can be exercised only if $X_i > X_G$ and the holder obtains an $\bar{\eta}$ fraction of the project's shares.
- There also exists a continuum of separating equilibriums where i) G-type issues debt with interest factor of $R_G = \frac{1}{p_G}$, and a barrier option with strike price zero which can be exercised only if $X_i > X_G$ and the holder obtains an $\eta > \bar{\eta}$ fraction of the project's shares, and ii) B-type issues a combination of debt and equity along the corresponding zero profit line ZP_B with $R_B > R_G$ and $\eta < \bar{\eta}$, or only debt with interest factor $R_B = \frac{1}{p_B}$.

Conclusions

In this paper, firms do not have any assets in place which could be used as collateral but they are allowed to issue any type of security they wish (including non-monotonic securities). We show that there always exists a fully revealing separating equilibrium (without any use of collateral) where the level of investment is optimal (first-best). The security issued by the high quality projects in this separating equilibrium is a barrier option. This option has a discontinuous payoff because it can be exercised only if the payoff of the underlying asset (project) is below or above a certain threshold which is determined endogenously.