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Two new equity default swaps with idiosyncratic risk☆

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ABSTRACT

We investigate two new types of equity default swaps: an equity-for-guarantee swap (EGS) and an option-for-guarantee swap (OGS). We calculate equilibrium prices for all components of the two swaps. Then we switch to utility-based prices of the entrepreneur's claims. Our analysis shows that under the equilibrium pricing, EGS is better than OGS but under the utility-based pricing, OGS is generally better than EGS. The OGS advantage over EGS increases quickly with the firm's cash flow level and is generally more pronounced when either the risk aversion, cash flow risk or the correlation between the cash flow and the market increases.

1. Introduction

The increasingly large role played by financial intermediaries, such as venture capitalists and angels, in nurturing entrepreneurial firms and in promoting product market innovation has led to great research interest in the area of entrepreneurial finance and innovation, as argued by Chemmanur and Fulghieri (2014). The top-tier scientific journal, the Review of Financial Studies, has dedicated the first issue of 2014 to entrepreneurial finance and innovation.

As a matter of fact, entrepreneurs often face financing difficulties due to their limited wealth, lack of collaterals, and other institutional frictions such as information asymmetry and agency costs, see, e.g., Álvarez and Vergara (2013). In China, there are a large number of Small- and Medium-sized Enterprises (SMEs) encountering financing problems and it is difficult or even impossible for them to obtain loans directly from banks. A lot of entrepreneurs have to give up investing in a new project even though the project is extremely profitable. Some entrepreneurs might luckily raise partial investment costs but they often have to pay too high interest to lenders.

On account of the financing difficulties faced by SMEs, the first credit guarantee institution, China National Investment and Guaranty Company Limited, has been founded by the Ministry of Finance and the former State Economic and Trade Commission in China since the end of the year of 1993.

Credit guarantee is clearly an important tool to spur entrepreneurial activities. For example, using public funds, the government of Shenzhen City in China has founded Shenzhen High-Tech Investment Guarantee Corporation (SHTIGC) since 1994 for the purpose of solving the financing problems faced by the companies that are small, early-stage, high-potential and high risk. After SHTIGC has been

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founded, many SMEs succeed in getting loans in time from banks with the help of its guarantee. Specifically, the amount of loans guaranteed was more than 100 million RMB in the first year and after that, the government of Shenzhen City invested 100 million RMB once again from the year of 1998 through 2000 to increase the equity capital of SHTIGC. Currently, the credit guarantee market has developed very fast and there were 4439 credit guarantee companies in China at the end of the year of 2011.

However, there is a major shortcoming in the original guarantee contracts, i.e. credit guarantee companies are exposed to too much risk of loss while the benefits they obtain are very limited. This is because credit guarantee companies only get a small fixed guarantee fee but must take over a very large default risk resulting from the uncertain incomes of the borrowers. One might argue that for this end, it is enough to increase the fixed guarantee fee. However, if we do so, the burden of SMEs must increase exactly at the time when they are hungry for money. This is unfavorable to enterprise development and is also adverse to the original purpose for the government of China to establish credit guarantee institutions.

To overcome the dilemma of choice, SHTIGC has invented two new equity default swaps (EDSs): One is Option-for-Guarantee Swap (OGS) invented in the year of 2000; the other is equity-for-guarantee swap (EGS) invented in 2002.

OGS is a three party agreement between a bank/lender, an insurer and an SME/borrower, where a bank lends at a given interest rate to an SME and if the SME defaults on the loan, the insurer must pay all the outstanding interest and principal to the bank instead of the SME. In return, the SME must give the insurer a call option to buy a given fraction of equity at a given exercise price. EGS is similar to OGS but differently, in return for the guarantee, the SME entering into EGS must directly allocate a percentage of the SME's equity to the insurer.

Obviously, OGSs and EGSs are similar with credit default swaps (CDSs), which are designed to transfer the credit exposure of fixed income products between parties. In a CDS, the purchaser of the swap makes payments (the CDS "fee" or "spread") up until the maturity date of a contract. Payments are made to the seller of the swap. In return, the seller agrees to pay off a third party debt if this party defaults on the loan, see Rutkowski (2009) among others.

However, OGSs and EGSs are more similar with EDSs, which are designed to deliver a protection payment to the EDS buyer at the time of the triggering event defined as the stock price decline below a pre-specified lower triggering barrier level. In exchange, the EDS buyer makes periodic premium payments at time intervals at the equity default swap rate up to the triggering event or the final maturity, whichever comes first, see Mendoza-Arriaga and Linetsky (2011) among others. For this reason, we think of both OGSs and EGSs as new EDSs since all of them are derivatives essentially underlying the value of equity of a firm.

Intuitionally, for risk-averse entrepreneurs (borrowers), insurers had better get guarantee fee as small as possible, say zero, at the start of a guarantee agreement since during this period, entrepreneurs have a strong desire for funds. In return for the guarantee, it is a good choice for insurers to get enough guarantee fee from the guaranteed entrepreneurs which are successful in the end. The larger the profit of their enterprises, the more the guarantee fee that the insurer should obtain. Clearly, both OGSs and EGSs rather than the ordinary CDSs or EDSs have such merit and this is why OGSs and EGSs are so popular to solve the financing problems faced by SMEs.

The insurer will have a double loss (by paying the outstanding notional and interest to the bank, and getting nothing from his/her claim) if default occurs. For this reason, one might ask why it would be reasonable for an insurer to issue either an EGS or OGS contract. Actually, in return for the possible double loss, the insurer obtains a fair amount of equity or a reasonable call option, by which the possible profit of the enterprise will exactly offset his/her possible loss. Indeed, the guarantee costs are essentially determined according to this standard.

As a matter of fact, by the end of February in 2004, 70 high-tech SMEs had been insured to get loans from banks by the SHTIGC under OGSs and the SHTIGC with most of the insured entrepreneurs benefit greatly from OGSs, reported on June 6, 2004 by a journalist from Xinhua News Agency. More specifically, among the 70 high-tech SMEs, the call option values of 43 enterprises, including Mindit, Coship Electronics and Scada, had increased, worth a total of RMB 10.77 million yuan, and four of the enterprises' options had been transferred, which gave the SHTIGC a substantial return on investment.

Recently, EGSs and in particular, OGSs have become increasingly popular as fund-raising tools among small and speculative firms because they are able to help entrepreneurs acquire finance easily and cheaply. According to a report from China Banking Regulatory Commission in June 11, 2013, the number of credit guarantee institutions in China surged to 8590 by the end of 2012 and the amount of the outstanding guaranteed loans arrived at 2.17 trillion RMB.

However, to the best of our knowledge, in the literature there is no paper that provides a quantitative study on OGSs and little is known about EGSs. For this reason, though all the parties in a swap agreement know that the number of the call option obtained by an insurer should be closely related with the guaranteed loan and the business risk faced by the guaranteed SME, we have no theory to tell them what the accurate relations would be. We know that OGSs are more popular than EGSs in practice but we have no idea about why this happens. From financial theory, it is well known that an asset of which the return is negatively related with the market would be more valuable but both OGSs and EGSs in practice have not taken this into account.

Our paper is related to Yang and Zhang (2013), who first provide a quantitative study on EGS. Using an equilibrium pricing method, Yang and Zhang (2013) provide the guarantee cost and optimal capital structure and quantitatively analyze the welfare improvement for an entrepreneur who enters into EGS.

In this paper, we utilize the same equilibrium pricing method but turn to OGS, which is much more complicated than EGS. We provide explicit equilibrium prices of corporate securities under OGS, including optimal exercise boundary of the option and the guarantee cost, which is the number of the option allocated by the entrepreneur to an insurer in exchange for the guarantee. In particular, we note that an entrepreneur is generally exposed to substantial idiosyncratic risk which is neglected by the equilibrium pricing method (i.e. the risk-neutral pricing). For this reason, we also use the utility indifference pricing method to compute the utility-based prices (subjective values) of equity held by the entrepreneur under EGS and OGS respectively. In contrast, it is reasonable to neglect the idiosyncratic risk faced by insurers since they generally sign many different agreements of such swaps with a lot of SMEs and thus the idiosyncratic risk is sufficiently diversified away. For this reason, we always price the insurer's claims by the equilibrium pricing

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