Investment, strategic debt service, and liquidation

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1. Introduction

In a contingent claim model, there are two kinds of bankruptcy strategies: liquidation ([1],[2]) and default (coupon reduction, [3],[4]). However, there are not many studies which includes these two strategies. In particular, previous studies have not clarified why the firm chooses which one of the liquidation and default strategies, as an optimal decision, on a certain condition. The purpose of our model is to show which one of strategies the firm prefers on a certain condition.

2. SW model

The firm posseses the option to invest in a single project at any time t. Then, if the firm pays a one-time fixed cost $I > 0$, the firm initiates the project. They assume that the firm issues a perpetual debt with coupon payment $c \geq 0$ to finance I. After initiating the project, the instantanous cash flow is $(1 - \tau)(X(t) - c)$, where $\tau > 0$ indicates the corporate tax and $X(t)$ is

$$\mathrm{d}X(t)/X(t) = \mu \mathrm{d}t + \sigma \mathrm{d}z(t), \qquad (1)$$

where $X(0) = x > 0$, $\mu > 0$, $\sigma > 0$, and $z(t)$ is a standard Brownian motion.

After initiating the project, if $X(t)$ decreaes, it is diffucult for the firm to pay c. They assume that the firm has the option of default (coupon reduction). During financial distress, equity and debt holders renegotiate the coupon reduction, where $\eta \in [0, 1]$ and $1 - \eta$ denote equity and debt holders' bargaining powers, respectively.

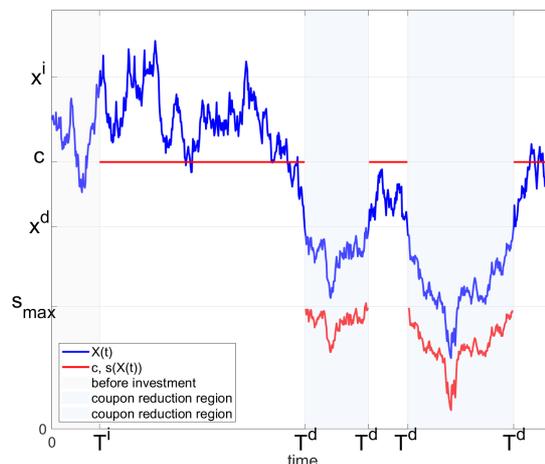Fig.1 depicts the sample path of cash inflow $X(t)$ with t (time), which demonstrates the

Fig.1　SW model

senario in the SW model. Let x^{i} and x^{d} denote the investment (superscript "i") and default (superscript "d") triggers, respectively. Once $X(t)$, starting at $x > 0$, increases and rearches x^{i} from below, the firm initiates the project by issuing a debt with the coupon $c \geq 0$. After that, if $X(t)$ decreases and rearches x^{d} from above, the coupon c is reduced to

$$s(X(t)) = (1 - \alpha\eta)(1 - \tau)X(t) < c, \qquad (2)$$

and $\alpha \in [0, 1]$ indicates the bankruptcy cost parameter. Again, if $X(t)$ rearches x^{d} from below, the reduced coupon $S(X(t))$ is changed to the normal coupon c. Importantly, during financial distress, the smaller $X(t)$ is, the smaller $s(X(t))$ is. Thus, in the SW model, they do not need to consider the liquidation.

3. Our extended model

In our model, we assume that the cost of investment, $I > 0$, is composed of two types: liquid (reversible) asset kI and unliquid (irreversible) asset $(1 - k)I$, where $k \in [0,1]$ represents the ratio of liquid asset. These assumptions are that $kI > 0$ is converted a cash when the firm is liquidated. Thus, the liquidation value is given as $(1 - \alpha)kI$, while the liquidation cost is αkI.

Under the above conditions, the firm has liquidation option in addition to default (coupon reduction) option. Let x^l and x^l_{BC} denote the liquidation triggers (superscript "l"), respectively, with and without default option. Here, BC stands for the [1] model.

4. Results

At the equilibrium, the optimal bankruptcy strategy is

$$\begin{cases} \text{Liquidation,} & \text{if } x^d \leq x^l, \\ \text{Default,} & \text{if } x^d > x^l. \end{cases}$$

Fig.2 demonstrates the senario where the firm takes liquidation strategy ([1],[2]). In this case, the liquidation value is relatively small. Fig.3 shows the senario where the firm takes default (i.e., coupon reduction) strategy ([3],[4]). Here, the liquidation value is relatively large. Thus, we show that the optimal bankruptcy strategy depends on the magnitude of the liquidation value.

We will give other interesting results at the presentation.

Acknowledgements

References

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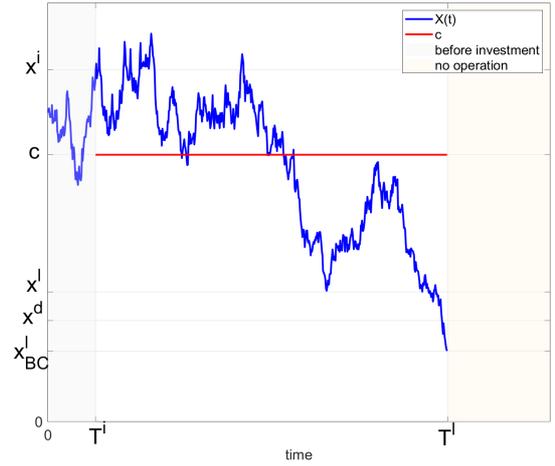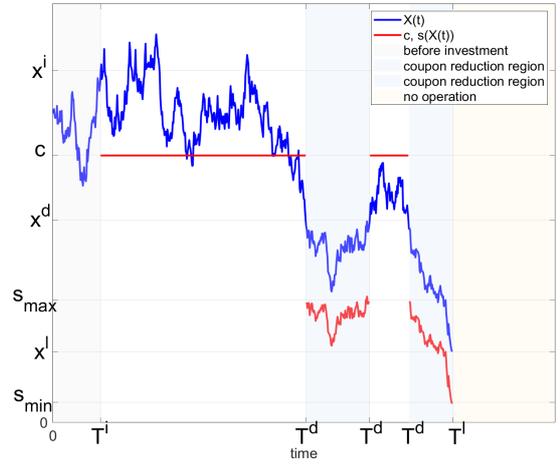

Fig.2 Liquidation strategy

Fig.3 Default stategy

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